Bureau of Business
APR 1 7 1937

The CORNELL ENGINEER

In This Issue:

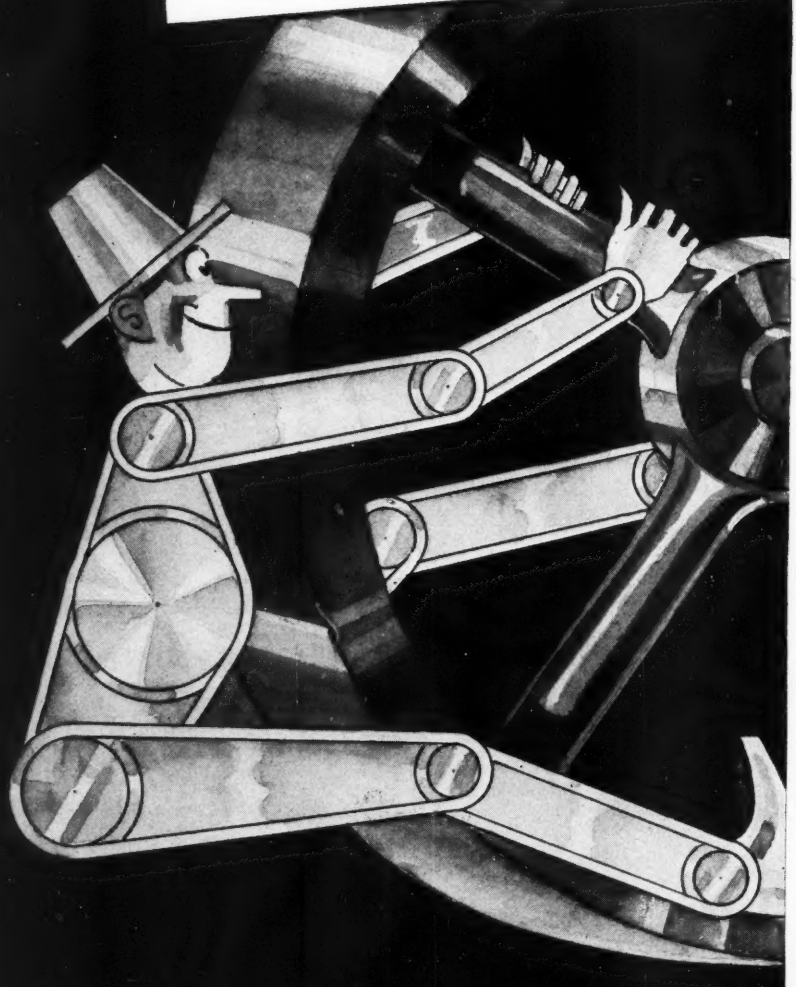
LOOKING AHEAD AT ENGINEERING

by L. W. W. Morrow

Volume I MARCH, 1936 Number 6

HE WORKS FOR NOTHING

...yet he costs you plenty



N. P. L.

(NEEDLESS POWER LOSS)

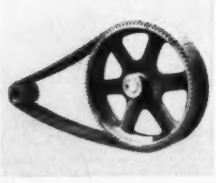
EVERYWHERE N. P. L. is a drag on efficiency and a menace to production. Daily he holds back the wheels of progress, and is the cause of costly shutdowns. Is this expensive parasite costing you plenty every day?

Morse Power Drives, properly engineered and installed, will eliminate N. P. L. Morse men, located in principal cities throughout the country, will aid you in ridding your premises of N. P. L. (Needless Power Loss).

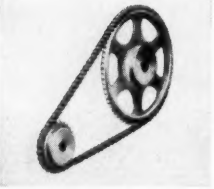
MORSE CHAIN COMPANY
Division of Borg-Warner Corporation
ITHACA NEW YORK

REPORT FROM MORSE CHAIN USER

"The chains provide positive power transmission with minimum loss, saving power and insuring maximum production through the operation of driven machines at proper speeds. The increased production of chain-driven machines was demonstrated by comparative tests in this mill. The short centers permitted by the chain drives save productive space, and the absence of line shafting improves light and operating conditions. The chains are encased, eliminating one important accident hazard."



SILENT CHAINS
Provide flexibility, extra load capacity, long life, low first and maintenance cost. Non-slipping, adaptable.



ROLLER CHAINS
A better roller chain. Unique joint construction—lubrication can reach wearing surfaces . . . smoother operation...and longer life.

MORSE *Positive* DRIVES

SILENT CHAIN and ROLLER CHAIN DRIVES • COUPLINGS • CLUTCHES

PRELIMINARY EXAMINATION
COURSE -- GORDON'S GAS STATIONS

1. Do you worry about B.T.U. values when you buy gasoline?

2. Do you know the dope on viscosity, flash and fire points, and acidity of lubricating oils?

3. Do you know why "RICHFIELD" products are superior?

4. Do you know that "GENERAL" tires and batteries are the best that can be bought?

- ANSWERS AT -

Gordon's Gas Stations

On The Hill
Ithaca & Dryden Rds.
Dial 2611

On The Level
Fulton & W. Buffalo Sts.
Dial 2006

Better . . because IT'S WELDED

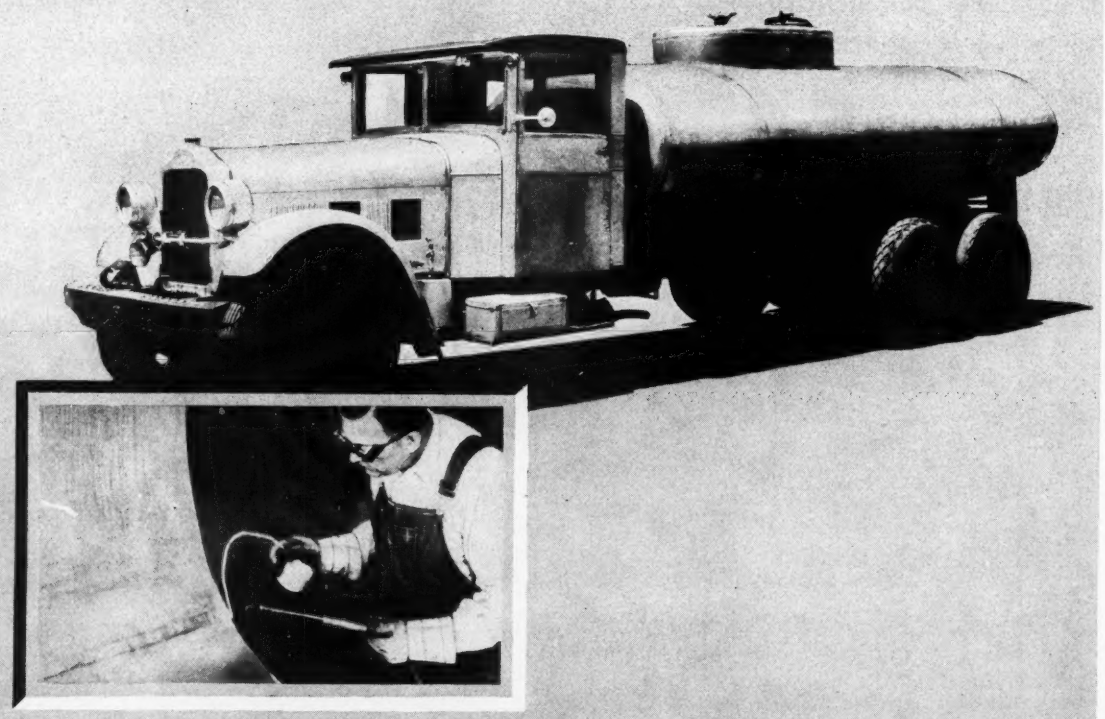
● The modern truck tank is *better because it's welded!* Welding—the jointless construction—gives greater strength with less weight and bulk . . . makes possible bigger pay-loads. The welded tank is seamless, smooth—inside and out—no rough spots for corrosion—no place for germs to lodge.

Welding has made many good products better—truck tanks, refrigerators, radios, streamlined locomotives, metal furniture, and a thousand other things. You, too, may find it profitable to consider the advantages in both production and sales which can be gained for your product by jointless design-for-welding.

Linde engineers will gladly cooperate with you in the design or redesign of your products for welding. The benefit of their broad experience is available from Linde Sales Offices located in thirty principal cities throughout the country and at 30 East 42nd Street, New York, N. Y.

The Linde Air Products Company
Unit of Union Carbide and Carbon Corporation

LINDE OXYGEN UCC UNION CARBIDE
PREST-O-LITE DISSOLVED ACETYLENE
OXWELD WELDING AND CUTTING APPARATUS AND SUPPLIES



Published at the College of Engineering, Cornell University, Ithaca, N. Y., by The Cornell Engineer Inc.

THE CORNELL ENGINEER

President
WILLIAM J. WEAKLAND, JR. '36 C.E.
Treasurer
O. ALLEN JILLSON '36 M.E.
Secretary
HOWARD T. CRITCHLOW JR., '36 M.E.

Volume 1 MARCH, 1936 Number 6

COMMENT

Mr. Morrow sheds light on society's dependence up and need of Engineers.

* * *

An economist of note, Mr. Fox reveals the intricacies of international trading and the governmental processes involved.

* * *

Engineering exactness as applied to all industries in the control of production is proven to be possible and practical by Mr. Gahnkin.

* * *

Mr. Davidson, the Winchell of the Engineering College, reveals Professor Upton—the scholar, the educator, and the man.

* * *

President Stahl asks all members of the Cornell Society of Engineers to take note of the University's administrative policy with regard to the Engineering College.

CONTENTS

Silhoutte of Hudson Avenue Station—the largest generating station in the world .....Cover
Courtesy Brooklyn Edison and "Power"

Library Tower, Cornell University .....Frontispiece
Courtesy Cornell Annuals

Looking Ahead at Engineering 129
By L. W. W. Morrow, '11

Reciprocal Trade Agreements Program 132
By A. M. Fox, '11

Control and Efficiency of Production 135
By V. G. Gahnkin, M.E. '16

Cornell Engineers 139
Professor G. B. Upton
By Sidney Davidson, M.E. '36

Cornell Society of Engineers 141

Editorials 143

Alumni Notes 144

College Notes 146

Stress and Strain 148

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

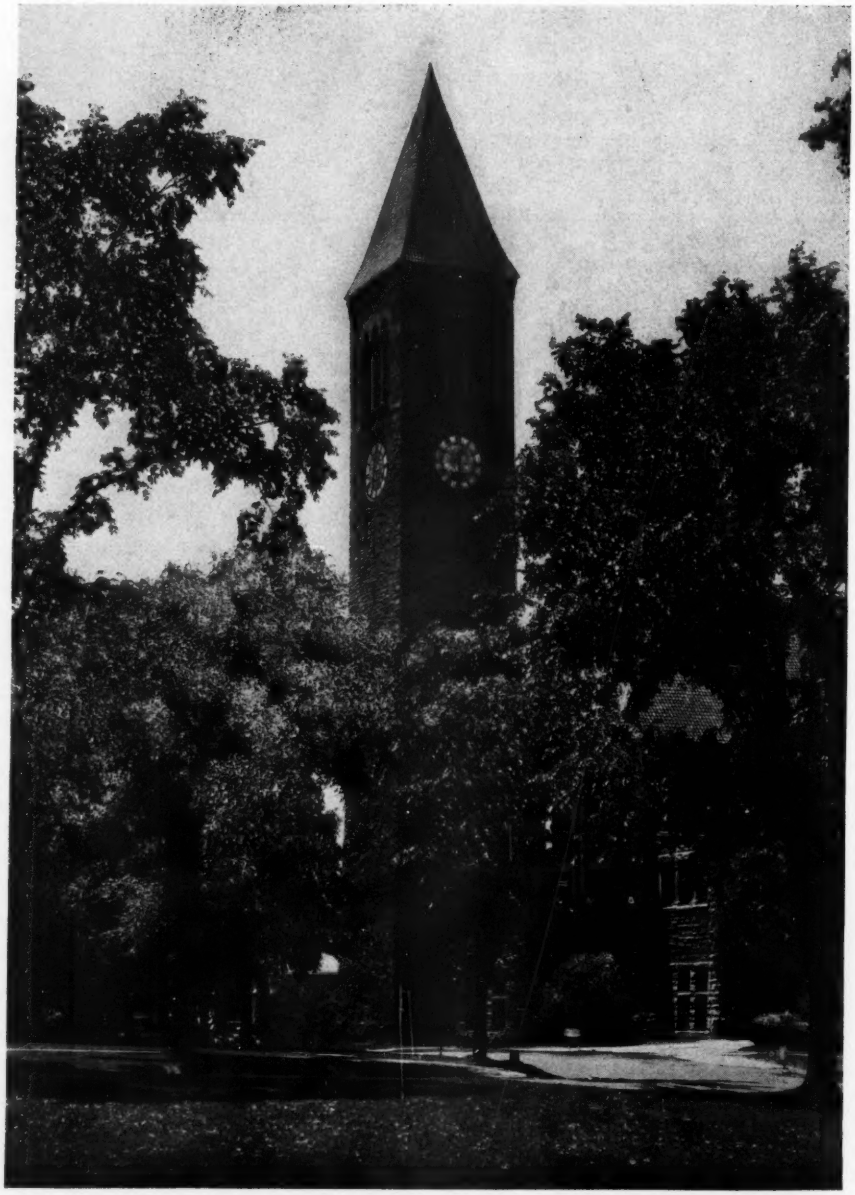
Chairman: LEONARD H. CHURCH

1510 Hanna Building, Cleveland, Ohio

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno Log
Nebraska Blue Print
New York Univ. Quadrangle
North Dakota State Engineer
Ohio State Engineer
Oregon State Technical Record
Penn State Engineer
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Villanova Engineer
Washington State Engineer
Wisconsin Engineer

Published monthly during the college year, October to to May. Subscription price for alumni through Cornell Society of Engineers, Resident $2.00, non-resident $1.50, non-alumni $2.00, foreign $2.50 payable in advance by Post Office money order, check, etc., to THE CORNELL ENGINEER, *Lincoln Hall, Ithaca, N. Y.* Price of this issue $.25. Advertising rates on application to the Business Department. Entered as second class matter at the Post Office at Ithaca, N. Y. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 1, 1918.

NORTON PRINTING CO. ITHACA, N. Y.



LIBRARY TOWER

Courtesy Cornell Annuals

THE CORNELL ENGINEER

Vol. I March, 1936 No. 6

Looking Ahead at Engineering

By L. W. W. Morrow '11

We are prone to exaggerate our troubles in this topsy-turvy world and to lack perspective when we consider current affairs. Just now our attention is turned to politics and many of us think salvation or destruction depends upon the votes counted this fall.

On this worldly stage of ours where human life plays its part, it pays us to look at the scale of things. With respect to the Lilliputian universe of the atom with its neutrons, protons and electrons we are gigantic. We can preen ourselves. But when we look up at the cosmic universe we begin to feel humble and infinitesimal. In one perspective we are smaller than any conceivable pygmy, but in the other we are larger than any conceivable giant.

Yet on this small stage a few score men have observed, reasoned and then created things that aid us and please us. Their work shows that man possesses an unlimited capacity for exercising his intelligence for creative acts.

Intelligence is the supreme power in this world when strengthened by training and endowed with patience.

But, by reason of what man has accomplished in science and engineering, it is argued that he can do similar constructive work with human affairs. This is the thought back of those who urge that engineers and scientists should cease their creative work in the material aspects of life and devote themselves to sociological accomplishments. It is argued that the same method, the reliance upon data and facts to reach logical conclusions, will be effective to bring order into human relations.

Yet individual human action and the human heart and mind are infinitely more complex than any atom or nebula. Law and order prevail in the universe of energy, but chaos exists in man. And assemblages of humans are even more unpredictable than individuals themselves. Is it any wonder that the labors of scholars in sociology and psychology have brought few results? Is it any wonder that no solution is available for human affairs and that history records no evolution, no improvement in either society or the individual?

Don't you think it a little unfair to tell the scientists and engineers that they should undertake to solve the enigma of man and society when, by type of mind and course of training, they are least fitted to undertake the task?

Our social problems are partly material and partly mental. We have factories, labor and capital; law and order and crime; housing; transportation; power; education; hygiene and a host of things that are a mixture of material things and such intangibles as traditions, ideals, rivalries, jealousies, greed and the variable working of the human mind alone and in mass.

And the solution of these social problems lies just as much in knowing the forces that motivate men, in understanding inherited tendencies, in evaluating acquired habits and in measuring individual mentalities as it does in knowing the laws of nature that control the material things.

A study of these values that lie in the heart and mind of man does not pertain to engineering and pure science and it is absurd to call upon engineers to forsake their profession to embark upon this new career.

The function of the engineer is to be creative in the material world. Let others apply the scientific method to solve the problems of humanity. Goodness knows enough people are now at work on this task even though some are boondogglers.

Back in the good old boom days engineers and scientists were lauded to the skies. They had brought prosperity by creating new things and new industries. They were economic angels as well as wizards. They are now condemned as the tribe of mechanical devils that have destroyed our economic and social structure.

We are told that machines, power, new materials and new constructions have gotten beyond the ability of society and business to use them intelligently. A vacation from technology is demanded so that government and society can catch up.

There is no truth in this assertion. The statistics show it isn't true. On the contrary, our troubles afford

an indictment of technology. Engineers are a quarter century behind the needs of the times, not ahead of them. If they had done their job there would be jobs for all and each of us would be made happy with money in our pockets.

Engineers did not create enough new things so that new industries could create more wealth and more employment. They did not reduce the costs of old things so that a more abundant flow of goods and services would provide more comfort, capital and labor. The job of engineers is to create new wealth and more jobs by using the resources of the limitless storehouse of nature.

What we need now is more technology, more research, more invention so that this country can go to work again and these things would have eliminated the necessity for the depression if engineers had not fallen down on their creative assignment in modern civilization.

Of course they have done much. If we were back in the gay 1890's what an enormous unemployment there would be with our present population and the need for work by men and women? We have built many new industries such as the radio, automotive, aviation, power and chemical to give people work and to create wealth. But we haven't done enough. We either quit to make money or we lost the urge to create.

We must go prospecting for more industrial gushers. We must seek new fields despite the fact that because of our accomplishments the technical industries have sprung up to give work to 10,000,000 people and to create the wealth and stimulus to American life. It is these industries that are needed for they never can find a saturated market. They fill our wants for beauty and comfort and luxury.

No matter what you do to agriculture each of us will eat just 2,000 pounds of food a year. You may change our diet but not the quantity. But the things that come from the technical industries are limitless in demand. Our ability to use them is bound only by the capacity of engineers and scientists to produce.

Thus one cannot help but say that the way out of our troubles is for engineers to stick to their profession and become creative. Our investment for depression relief should be put into scientific research and engineering development and I don't care how much the national debt is increased in so doing. The money will be returned with a profit. We need more products, more factories to make new products, less expensive products and new and better services. These must come from nature at the command of the creative intelligence of engineers.

Some day we will have the homes and buildings architects dream about. Some day we even may have synthetic food and therefore landscape our farms to create beauty. Even now we need no wood because synthetic materials are available and the many new forests of the CCC boys are beauty spots of the future rather than potential wood resources.

But hold up. We are told that there are too many engineers and moves are already under way to restrict their numbers. Statistics are quoted to prove the necessity for restriction.

For example, during the 30 years from 1900 to 1930 the number of physicians decreased from 1,420 to 1,050 per million of population; the number of lawyers was reduced from 1,280 to 1,120; the number of architects remained constant at 300 and the number of engineers increased from 420 to 1,590.

The engineering schools of this country graduate over 10,000 engineers annually, the number removed by death each year is 4,000 leaving an annual increase of 6,000 engineers net. In the 1930 census there were 175,000 engineers in this country. From this data it appears that saturation is now had in the engineering profession and that overcrowding must result unless steps are taken as in law and medicine to restrict entrance to the profession or engineering graduates must embark upon other activities than the practice of engineering.

One approach to restriction is the use of licensing laws and this system also speaks to advance the status of the profession by legal means. This movement started in Wyoming in 1907 and has increased rapidly until today some 35 states have some form of licensing laws for engineers as well as architects. As of July 1, 1935, there were 35,000 licensed engineers in this country out of the total 1930 census number of 175,000.

This new movement is restrictive. It is a guild and not a professional movement. It limits the use of the word engineer to those who are qualified and who are engaged in technical work. It follows the trend of law and medicine in a legal approach to a professional status.

Within its scope this licensing movement is sound. But it is false to assume it is the complete definition of engineering or of the engineer. It measures a stage in his career. For unlike law and medicine engineering is not a personal service rendered to individual clients. It is a function in our modern civilization. The members of the profession wield the tools of science for the benefit of humanity, and technical skill is but a part of the rounded engineer.

Let's take another type of statistical view of the engineer. Let's look at the notable men in Who's Who. Checked in 1929 by L. W. Wallace, he found 28,805 men of whom 30.4 percent were men of science and engineering, 15 percent lawyers and 7.3 percent physicians and surgeons. The 2,858 engineers and architects held 4,785 official positions in 3,928 organizations of which 2,993 were industrial and commercial enterprises. They occupied the position of president in 1,128 industrial and commercial organizations, 72 engineering firms, 68 banks and trust companies and 23 colleges and universities. Among these 2,858 engineers and architects there were or have been 10 governors, 13 members of Congress, 2 Cabinet members and a President of the United States.

This is our top list. Doesn't it show a sample that indicates the engineer as a leader, as a functional man in modern civilization who does things that are social, economic and also technical. Is it any wonder that engineering colleges say "We train men for life, not for technical engineering."

But let us take still another statistical view of the engineer today. Only 35,000 of the 175,000 engineers are registered or licensed. What are the others doing? In these great technical industries that involve assemblies of mechanical equipment, the use of power and a knowledge of underlying science, there is need for a technical operating and maintenance staff. By far the larger number of engineers thus are staff men in these technical industries. Their work does not require personal and precise technical spcialization. It is functional. These men see that production occurs economically and continuously. They staff the industries in low and high ranks and yet they call themselves engineers.

Some are maintenance men, some are designers, a large number are operating superintendents, others are in specialty departmental organizations, many are managers and executives. This is the field into which the normal engineering college graduate finds a place. Surely here we need no restrictions. Industry needs more intelligently trained engineering graduates to man its staffs.

And let us go still further in a study of the engineer at work. If you consider an engineer as simply a specialist in applied science what will you call the physicist and chemist with their Ph.D's who are entering the field of research in technical industries in ever growing numbers? They compete with the specialist engineer. They have a longer and more thorough specialized training. If the engineers, or some of them, are going to maintain their position in this realm of engineering activity then they must go to school a longer time and specialize in science to a larger degree.

At the other extreme are the inventor types. Do you think Edison could pass an engineering examination or receive a license if the present laws prevailed in his early days. The wizardy of an inquiring mind is not an orthodox thing. It is a gift of God that cannot be removed by an Act of Congress and needs no Supreme Court to defend it. Yet the creative things in the world come from minds of the Edison type. The orthodox members of the profession merely perfect and improve upon the original creative idea.

Thus an analysis of what engineering is and a definition of engineering in terms of the men in the profession finds us facing several groups:

1. The creative technical group who work as individuals. Some are engineers by training, some are scientists by training and some are inventors without orthodox training. We should never restrict the numbers in this field. This is the group that produces the wealth, the jobs, the industries so badly needed in this world. Yet the plea that pay is low, recognition is poor and professional status indeterminate. Thoughtful consideration must be given this proposal. Undoubtedly bad conditions exist. But is there a fundamental need to restrict engineers in this field? Doesn't industry need more trained men in all its activities?

A further thought is that men in this field of engineering activity are merely engineers for a certain part of their career. They are trying to pass from engineer to sub-executive to executive. With artificial definitions and restrictions under these conditions, how is it possible to define or to restrict either engineering work or the moment a man passes into or out of responsible technical work?

One cannot help but feel that a decided clarification of thought is needed before rigid restrictions are placed upon engineers as they serve in all positions of industry. We need more and better engineers. We need more engineers to advance to executive positions. We need more engineers to reduce costs and improve production. The restriction stage has not been reached.

2. As pointed out a great many engineers are educated as a preparation for life. When they graduate they go into sales, law, banking, accounting, business and a variety of pursuits that offer careers to men equipped with a fundamental knowledge of science and the engineering method of study and conduct. These men often call themselves engineers because of their education and because the market, if measured in cold business terms, is limited because each industry and each research laboratory have but few of this type and these are largely routinized. The conclusion is inescapable that if this type is to grow in numbers there must be two things established (1) an aid or support from industry that is now missing or (2) a greater reliance of each individual in the group on his own creative power to force recognition of his talents and his creations.

3. The technical staff of industry. This group now dominates the profession. They are even starting a guild movement to make definitions and to limit admissions on some aspects of their work call for the exercise of engineering knowledge and judgment. Shall we disown them? Shall we restrict the number that may have this training or that undertake these activities? I doubt it.

Thus any analysis of engineering and any look ahead at the future leads us to say that we need more and better engineers and not fewer. It leads us to say that definitions and restrictions should be made only after careful consideration of all the elements involved. The more one studies the situation the more complex it becomes and the less one cares to generalize or to take specific action that would limit the profession in scope or activity. This world needs engineers. They are working out their salvation and the world's salvation. The idea of regimentation or restriction should be repugnant to them at this time in view of the needs and opportunities for engineers in this troubled world.

Reciprocal Trade Agreement Program

*By A. M. Fox, C.E., 1911

In the summer of 1934 the United States entered upon a comprehensive program of negotiating trade agreements with many nations. This program, generally considered to constitute an important long-range step toward economic recovery, should be of considerable interest to engineers, irrespective of their political affiliations, the particular interests of the localities from which they come, the industries with which they may be connected, or even the tariff views that they may entertain. You may take issue with some of the underlying principles of the program; they may clash with the self interest of your particular group or of the section of the country from which you hail. But if you are an undergraduate and have gone far enough to be interested in effective methodology—or if you are a graduate, whether or not you have continued actively to practice engineering, and have been out of school long enough to have observed the importance of thorough and painstaking analysis, especially in the social sciences,—you will be intensely interested in the reciprocal trade-agreements program.

I

I need not explain to engineers the importance of trade to industry. You appreciate fully that perfection of the productive processes is not alone sufficient but that improvement in methods of distribution and the development of new markets are vital to the success of industry. This is manifested by the fact that as many engineers are engaged in non-technical phases of industry as in the strictly technical and scientific.

The United States has for generations taken a leading place among the trading nations of the world. The trade-agreements program was undertaken in 1934 to restore to us a normal amount of international trade, as we had been losing our share of world trade at a more rapid rate than was the rest of the world. Between 1929 and 1932 world trade declined 60 percent; that of the United States during the same period declined 70 percent. In 1929 the total exports of the United States were valued at 5,421 million dollars; they declined in value in 1932 to 1,611 million dollars—or by 70 percent; there was a slight increase in 1933 to 1,675 million dollars. In 1934 there was an advance to 2,133 million dollars and in 1935 to 2,282 million dollars.

General imports into the United States fell from a value of 4,399 million dollars in 1929 to 1,323 million dollars in 1932, a decline of 70 percent, and increased slightly to 1,449 million dollars in 1933, to 1,655 million dollars in 1934, and to 2,047 million dollars in 1935.

The turn of the present century saw a change in the character of our exports. Although agricultural products were still important in our export trade, newer products from many new industries, couriers of America's rising industrial strength, assumed a dominant position in the world markets. Manufacturers in large numbers are now faced with huge surpluses of a long list of industrial products, or with unused plant capacity, unless they find foreign markets for considerable portions of their production. To name just a few products needing outlets: In normal times we export 40 per cent of our typewriters, 29 percent of our printing machinery, 28 percent of our sewing machines, 23 percent of our agricultural machinery, 20 percent of our locomotives, and 14 percent of our automobiles. These and many other manufacturing industries depend upon mass-production methods and are industries in which a decline in output causes unit costs to increase and leads to unemployment and to handicaps in marketing even in the home market.

Those branches of agriculture which normally export considerable portions of their production—cotton, 55 percent; tobacco, 40 percent; lard, 30 percent; and wheat, 18 percent, to name just a few—have also in late years faced a serious situation, aggravated by their inability to curtail production as does industry under such circumstances. When export trade falls off such farm commodities cannot command reasonable prices, since their supply continues to pile up even after the demand for them has fallen off. Such unsalable surpluses inevitably lead to demoralization of the price structure. It is contended that real recovery in the United States cannot be accomplished until we succeed in unearthing markets for our agricultural and industrial "surpluses." The goal of the trade-agreements program is the recapture of old, and the creation of new, foreign markets.

II

Even more serious than the decline in foreign trade is the retardation in recent years of the natural movement of trade by the enactment of prohibitory tariffs, quotas, embargoes, sanitary restrictions, exchange controls, clearing agreements, and other restrictive devices. To surmount the difficulties caused by the multiplication of trade barriers throughout the world, foreign countries have resorted with increasing frequency to the negotiation of international tariff and trade agreements; about 68 such

*A. M. Fox is director of Research, United States Tariff Commission, Washington, D. C. He has served on the faculties of the University of Michigan, the College of the City of New York, and the Catholic University of America; in the Cost Department of Dodge Bros. Motor Company; as investigator in the Detroit street railway and telephone rate cases; as examiner of the Michigan Tax Commission; and as assistant to the General Valuation Counsel, New York Central Lines. Mr. Fox also has the degree of A.M. from New York University.

agreements have been formulated since January 1, 1933. The United States alone, among the major commercial powers of the world, was until June 1934 without Executive authority to negotiate trade agreements which could be put into force promptly without parliamentary ratification.

Our present trade-agreements program is being carried out under the authority of an act of Congress approved June 12, 1934, as an amendment to the Tariff Act of 1930. It adds to Title III of that act a new part entitled "Promotion of Foreign Trade." Under this amendment Congress gives the President power to enter into foreign trade agreements "for the purpose of expanding foreign markets for the products of the United States." This amendment is designed to encourage international trade by providing for reductions in United States tariffs, within specified limits, in exchange for the modification of trade restrictions by foreign governments. No United States rate of duty may be changed more than 50 percent, nor can any article be transferred from the dutiable to the free list. Although the amendment prescribes that any duty modification made as a result of a trade agreement with any country shall apply to all other countries, the President is authorized to refuse the extension of concessions to countries which discriminate against United States commerce or which pursue policies tending to defeat the purposes of the act. An agreement negotiated under the act does not require Congressional ratification.

Trade agreements have already been negotiated with Cuba, Belgium, Brazil, Sweden, Haiti, Colombia, Canada, the Netherlands and its overseas territories, Honduras, and Switzerland. Negotiations with a number of other countries are in progress. The interest which many countries have shown in the possibility of negotiating trade agreements with the United States indicates that the world is not yet irrevocably committed to increased restrictions of international trade. It encourages belief in the feasibility of breaking down, under difficult and trying conditions, trade barriers throughout the world.

III

Assuming that the increasing restrictions imposed upon foreign trade are undesirable and that at least some assistance to economic recovery may be expected from an increase in foreign trade, it can readily be observed that the reciprocal trade agreements are of considerable importance in restoring the prosperity of the nation. The trade-agreements program, whatever else it may be attempting to accomplish, is endeavoring to reduce and remove trade barriers. To effect a trade agreement the United States must, in return for the modification of trade barriers by a foreign country, reduce some of its tariffs. As tariffs cannot be indiscriminately and sharply reduced during a period of widespread unemployment without serious repercussions, the utmost care must be exercised in the selection of the rates of duty that are to be reduced. The extent to which particular rates can be modified and the probable effects of each change must be judiciously weighed. The best results can be obtained only if the work is carried on by experts and organizations that are qualified to examine objectively the economic and competitive factors affecting the trade in each commodity.

As the process of tariff revision by Executive authority on the basis of negotiation with foreign governments represents a new departure in American administrative practice, new machinery had to be created. Upon the passage of the Reciprocal Trade Agreements Act the State Department created a new division, that of Trade Agreements, and a number of important interdepartmental committees were organized, on each of which were representatives from several departments: State, Agriculture, Commerce, Treasury, and the United States Tariff Commission, and until the rendering of recent Supreme Court decisions, representatives of the National Recovery Administration, the Office of Special Adviser to the President on Foreign Trade, and the Agricultural Adjustment Administration. Direct responsibility for the work is vested in the Department of State which has charge of the actual negotiation of the agreements. An interdepartmental Trade Agreements Committee is charged with the responsibility of directing the preparation of all necessary studies, of reviewing recommendations of subcommittees, and of approving all trade agreements in all details and at their various stages. This Committee in turn has organized a number of supporting committees, the most important of which are the "country" committees, one for each country with which a trade agreement is to be formulated. On these committees also are representatives of the various departments. Each country committee is charged with the responsibility of preparing the basic information for the particular country with which negotiations are to be carried on.

Data covering each item on which a concession may be granted a particular country are prepared by the experts of the United States Tariff Commission; for the concession to be asked from the foreign country, by the Department of Commerce. Experts of the State Department in conjunction with those of the Bureau of Customs usually prepare the so-called "general" provisions of each trade agreement and the Department of Agriculture furnishes special information on agricultural commodities. Each country committee prepares for the particular country a number of reports giving the economic background and the trade between that country and the United States, together with a detailed analysis of the economic factors pertinent to each commodity concerning which a concession is to be considered.

Some idea of the comprehensiveness of the study made for each country may be gathered from the fact that the

analysis of the items for which concessions to Belgium were to be considered covered 15 volumes, each the size of a telephone directory, and together filled one section of a standard office bookcase. Although studies were made for 165 items with respect to which concessions might be made to Belgium, concessions were ultimately made on only 47 items.

For the more important commodities or groups of commodities there are also "commodity" committeees upon which serve technical experts from the various governmental departments. These committees are charged with the responsibility of assembling all essential information with respect to their commodities, and of studying the effects which changes in rates of duty might have upon the economic situation in the industry or industries affected. In many instances these commodity committees have prepared very elaborate reports. Other special committees have studied other problems, such as quotas and exchange control.

Service on these various committees has brought together men and women particularly qualified and expert in the subjects dealt with, and to these committees the records and information, both public and confidential, of the various departments have been made available. Technical experts have often been called before a number of these committees as consultants with respect to certain commodities.

Another important instrument for carrying out the trade-agreements program is the Committee for Reciprocity Information. This committee was organized by the Executive Committee on Commercial Policy, which had been created by Executive order to coordinate the commercial policies of the various governmental departments. After it is announced that a trade agreement is to be undertaken with a particular country, a date for a public hearing is set by the Committee for Reciprocity Information, 30 or more days thereafter. The purpose of this hearing is to give opportunity to interested parties (producers, importers, exporters, and consumers) to appear and present information upon the particular subject in which they are interested. In the hearings thus far held they have usually set forth the reasons why particular rates of duty should not be reduced, have called attention to particular restrictions in foreign countries which deterred the flow of trade, and have attempted to show what concessions should be sought from the foreign country with which negotiations had been undertaken. The hearings usually are followed by a voluminous correspondence. Transcripts of each hearing, together with all briefs submitted and all correspondence received on each subject, are summarized carefully by the technical experts and economists of the Tariff Commission and the summarized statements are circulated among the members of the "Country" and Trade Agreements Committees and other interested government officials. This new service, provided for the first time in connection with the trade-agreements program, has assured serious consideration of the representations of all interested parties.

After the members of the country committee have carefully reviewed all available data gathered for it by the experts of the various departments, or presented by interested parties before the Committee for Reciprocity Information, or prepared by special committees organized from time to time, a special report is presented to the Trade Agreements Committee. This report usually gives the essential economic background for the particular country, the outstanding restrictions that should be removed or modified, and detailed economic information and recommendations concerning each commodity with respect to which a concession is recommended. After deliberation on this report, including its recommendations, the Trade Agreements Committee prepares a special report setting forth the concessions which it recommends for review by the State Department officials and for final approval by the President.

A few members of the country committee, serving as negotiators, then undertake actual negotiations with representatives of the foreign country. After weeks, and sometimes months, of actual negotiation, a tentative trade agreement is prepared. This is given careful review by the particular country committee and, together with the recommendations of the country committee, is reviewed by and approved by the Trade Agreements Committee for official acceptance.

This recital of procedure should be sufficient to show that before any trade agreement is formulated all available information bearing upon the particular country and the items of trade between the United States and that country have been carefully canvassed. Technical, economic, and other experts in the several departments are consulted, and all information furnished by interested parties is carefully reviewed. It must also be appreciated that there are many opportunities for the presentation of varying points of view. Final decision in any matter is reached only after a great deal of study, deliberation, and debate, and in some cases only after compromise of conflicting views. And in every instance the economic consequences of each action are carefully weighed before the decision is reached.

There may be differences of opinion as to the merits of any particular action or as to some of the principles underlying the trade-agreements act, but it is difficult to see how anyone at all familiar with the procedure outlined above can fail to be impressed with the thoroughness with which each item is considered. Whatever the final opinion of the trade-agreements program may be, the system of collecting vital information concerning each item and of the various checks and balances assures such careful deliberation on each item as to make certain that a new method of tariff technique is being developed.

Control and Efficiency of Production

By V. G. Gahnkin '16

The control and efficiency of production has long been the subject of serious study in manufacturing plants, particularly where the product can be measured objectively in the form of separate units such as automobiles and their component parts. In other industries the detailed and continuous analysis of the processes of production was either on too small a scale or not economically justified due to the inherent inefficiency of the equipment by which it was manufactured. The early history of the electrical industry is an example of the latter. In its inception it was very difficult even to measure the amount of the electricity produced and as a consequence a wide variety of billing methods was introduced. Coincident with the turn of the century, and the ever increasing importance of the electrical industry, more and more attention has been paid to the separate processes and equipment which are combined in the power plant until in a modern station, not only are the characteristics of each piece of equipment known to a high degree of accuracy, but their proper combination, under varying conditions of production, is mathematically determinable. This has all been brought about through intensive experimentation and research not only in the laboratory but in the power plants on the large boilers and turbines. This development has coincidentally entailed the devising and perfection of very numerous instruments for measuring the variety of conditions and processes inherent in power plant operation.

Many of us who graduated twenty or more years ago knew from experience that any instrument beyond a pressure gauge on a boiler was considered a test instrument and that setting up and running a complete test on a boiler, pump, turbine, or generator was a very special and unusual situation. Today in the best power plants complete and accurate tests on all major equipment is a periodic affair and tests on minor equipment are relatively frequent. In addition to this each piece of major equipment has recording instruments which give a continuous record of its performance.

The inception of much of this development rests with the excellent, thorough, and inspirational work in experimental engineering done by Professors Carpenter and Diederichs with their able and enthusiastic staff. What has really happened in the last twenty years is that the greater part of what was then considered experimental engineering has attained the status of continuous control engineering in the modern power plant. This is perhaps best illustrated by the fact that after accurate acceptance tests of station equipment have been made throughout the operating load range, the normal daily and accumulated monthly performance of all the equipment combined will agree within a per cent or two of the performance, for the same period, computed from the test characteristics. Another major result which is attained from accurately determining the characteristics of power plant equipment equipment is the ability to derive the data necessary for determining the allocation of successive increments or decrements of production. Without this information it is impossible to take full advantage from hour to hour of obtaining the most economical production; particularly with the widely varying load with which utilities must contend.

For special testing of power plant equipment such as acceptance tests and tests for determining the effects of changes in design very elaborate and detailed procedures have been set up by committees representative of the industry in the national engineering societies. These codes are reviewed from time to time to include developments in instruments and methods. Their purpose is twofold, the first one being to outline the best available method for making the test and the second to set up rules which will determine as between manufacturer and purchaser, the basis for making and settling contractual obligations.

As is sometimes the case in fields of endeavor where scientific control has lagged, when it is accepted and developed, those who are just entering the field out-run the earlier entrants and carry the processes to a higher degree of perfection. This has been true in the case of the large utility companies and the processes are already showing signs of acceptance and application in other industries. The problem of allocating production in general does not receive the same concentrated attention that is given to engineering and design problems. Perhaps because in many cases production allocation is considered a self-evident problem and rule of thumb methods sufficiently accurate. In the utility field, savings of as much as ten per cent may be realized on production costs purely through the proper methods of load allocation; that is the difference between what were at one time considered as acceptable methods of allocation and the latest developments in allocation which make use of the individual characteristics of all equipment operated in unison. These savings may be directly attributable to careful testing, which in the past had been considered as an unnecessary item of expense. It is recognized that basically any manufacturing plant, with all elements considered, has a certain characteristic performance with respect to input and output as the output varied. This characteristic, of course, is made up of various component parts and may be either a continuous characteristic or appear to be a discontinuous one. The application of the method which is called the incremental rate method of allocating production is based upon the condition that the input-output characteristic of the plant can be determined. In the case of a power plant this characteristic can be accurately established and the following illustration taken from the electric utility field has a

general application. Figure 1 gives a graph showing the essence of the problem of production allocation by the incremental method. This method may be considered as one which assigns any added increment of production to that station or generator, already in operation, which can produce the added increment of output at the least cost. In the illustration a small inefficient station is shown operating in conjunction with a large efficient station. The solid

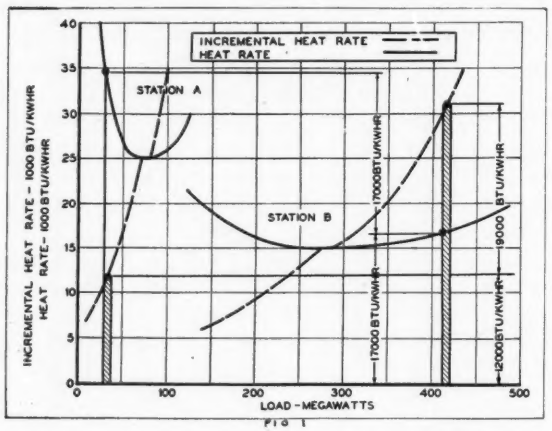


FIG. 1

"U" shaped curves indicate the unit production input at any given station output. The dashed curves which cross the full line curves represent at any given output the required input for an added unit of output above the amount already being carried. Assuming the solid circle on Station A to represent the minimum required output for the station and the solid circle on Station B's characteristic curve to represent the load it is carrying coincidentally, it would certainly appear offhand that any added production should be placed on Station B as it is actually producing a unit output for exactly one-half of that eb-ing produced on Station A. However, by referring to the incremental curve, it will be seen that Station A can pick up the added unit of production for 12,000 Btu whereas Station B would have to expend 31,000 Btu for the added unit of production. This apparent paradox is explained by the fact that the *total* output on Station A after picking up the next unit of output would be at a lower unit cost than before and, therefore, all of the initial output would contribute toward the additional unit of output. On the other hand Station B is operating at such a point that in picking up an additional unit of output all of the load would be produced at a higher unit input, thus adding an excess burden on the additional unit of production. Due to the fact that the actual determination of increment curves from station characteristic curves involved initially the development of a rather careful technique, and also due to the fact that the accurate testing of power plant equipment in itself was rather an expensive item the impression prevailed that the application of incremental rates to these problems of allocating output was not practical even if theoretically sound. However, progress in the methods of interpreting the production characteristics has made possible practical solutions to the incremental rate problem which gives results closely consistent with the theoretical solution, and which are applicable not only to the utility industry but to any manufacturing process.

In order to present an outline of the elements for determining incremental rate curves some basic examples taken from the utility field will be used. When two or more machines or boilers, or groups of machines and boilers are operated jointly, the combined efficiency of operation is materially affected by the division of the total output among the boilers and machines. It has been proved mathematically and substantiated in practice that the maximum combined efficiency is usually obtained when the machines or combinations of machines and boilers are operated at outputs corrseponding to equal incremental rates. This fact establishes a definite relation between the total output and the outputs of the individual elements. In order to determine this relation it is necessary to know for each piece of equipment the relation between its output and its corresponding input. This relationship is defined by the efficiency curve or by the more fundamental input-

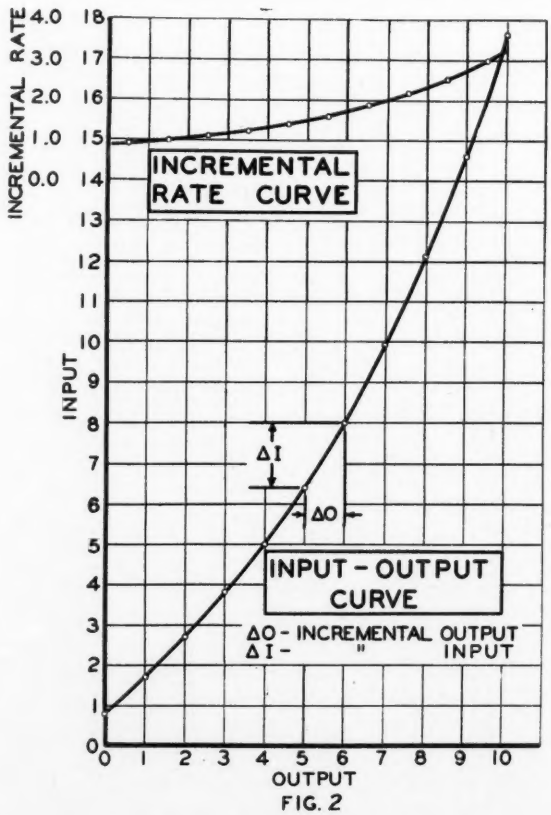


FIG. 2

output curve. The latter is normally used in computing incremental rates. By referring to Figure 2 it will be readily seen that at any given output the slope of the input-output curve at the point corresponding to that output represents the *rate of increase* of the input. Thus, the

increment rate may be derived by several methods. When the input-output curve can be expressed by an algebraic equation the incremental rate follows by differentiation since it is the first derivative of the equation for the input-output curve. Graphically, a solution may be made by drawing tangents to the input-output curve and taking the slope of the tangent for the incremental rate at the given output.

The physical significance of the incremental rate may be illustrated by considering two boilers supplying a common load and operating at equal outputs with incremental rates and efficiencies as shown below.

	Boiler A	*Boiler B*
Boiler output, million Btu per hour	10	10
Incremental rate	1.42	1.33
Boiler efficiency, per cent	80	70

If it were necessary to increase the total output by one million Btu per hour, then the additional output should be supplied by boiler B, notwithstanding the fact that boiler A is more efficient. The criterion is not the relative boiler efficiencies, but the relative efficiencies of generating the additional or incremental outputs. Thus the incremental inputs for the additional output would be 1.42 and 1.33 million Btu per hour, respectively, for boilers A and B. The efficiency of generating the additional output would be $\frac{1 \times 100}{1.42} = 70.42$ per cent for boiler A and $\frac{1 \times 100}{1.33} = 75.19$ per cent for boiler B.

Thus, it is the efficiencies of generation of the incremental outputs or the incremental efficiencies which should determine the division of load between boilers or machines, and not their respective absolute efficiencies.

Since the incremental rate was defined as the ratio of incremental input to incremental output, the incremental efficiency expressed as a decimal becomes the reciprocal of the incremental rate.

In the majority of cases it will be found that the input-output curves as well as the first derivative or incremental curves are continuous but there are cases where either one or both may be of a discontinuous nature. In such cases additional studies must be made to develop approximate input-output and incremental curves which can be used without introducing more than a negligible error. As these conditions do not affect the basic theory and require rather lengthy treatment no further discussion of this phase will be given in this article.

In addition to the fundamental efficiency curves obtained from testing, certain correction factors must be applied to modify the characteristics of the equipment in accordance with deviations in cleanliness, temperatures and pressures existing at the time the division of production is made among the operating elements.

The derivation of the conditions giving maximum efficiency is shown by the following mathematical analysis when two production units of different characteristics are supplying a common demand.

Let

O_t = total output of the 2 units

O_1 = output of unit No. 1

O_2 = output of unit No. 2

I_t = total input to the 2 units

I_1 = input to unit No. 1

I_2 = input to unit No. 2

It is assumed that $I_1 = F_1(O_1)$ and $I_2 = F_2(O_2)$ represent 2 continuous input-output curves, and have continuous derivatives, $\frac{dI_1}{dO_1}$ and $\frac{dI_2}{dO_2}$, respectively, which always increase as O_1 and O_2 increase. Therefore, the second derivatives, $\frac{d^2I_1}{dO_1^2}$ and $\frac{d^2I_2}{dO_2^2}$ are always positive.

$$I_t = I_1 + I_2 \tag{1}$$

and

$$O_t = O_1 + O_2 \tag{2}$$

The problem is to determine for any given value of O_t, for example O_a, the values of O_1 and O_2 which will make I_t a minimum. Then

$$O_1 + O_2 = O_a, \text{ a constant} \tag{3}$$

$$O_2 = O_a - O_1 \tag{4}$$

$$I_t = I_1 + I_2 \tag{5}$$

Now, since its second derivative is positive, I_t will be a minimum when its derivative with respect to O_1 vanishes.

Or

$$\frac{dI_t}{dO_1} = 0 \tag{6}$$

But

$$\frac{dI_t}{dO_1} = \frac{dI_1}{dO_1} + \frac{dI_2}{dO_1} \tag{7}$$

$$= \frac{dI_1}{dO_1} + \frac{dI_2}{dO_2} \times \frac{dO_2}{dO_1} \tag{8}$$

Furthermore

$$\frac{dO_2}{dO_1} = \frac{d(O_a - O_1)}{dO_1} = -1 \tag{9}$$

Hence

$$\frac{dI_t}{dO_1} = \frac{dI_1}{dO_1} - \frac{dI_2}{dO_2} \tag{10}$$

Equating eqs. 6 and 10

$$\frac{dI_1}{dO_1} - \frac{dI_2}{dO_2} = 0 \tag{11}$$

Or

$$\frac{dI_1}{dO_1} = \frac{dI_2}{dO_2} \tag{12}$$

This means that the minimum input for a given combined output is obtained when the incremental rates of the 2 units are equal. Furthermore, there is only one pair of loads for any given output at which the incremental rates will be equal.

With the foregoing brief outline of the development of the increment characteristics of power plans it might be interesting to review some of the practical aspects

LOADING SCHEDULE FOR 55° F CIRCUL ATING WATER

Station Load	Unit Combinations															
Mw	7	8	6	8	6	7	8	5	6	7	8	4	5	6	7	8
70	35	35	25	45												
80	45	35	25	55												
90	55	35	25	65												
100	55	45	25	75												
110	55	55	30	80												
120	60	60	40	80												
130	70	60	40	90	25	55	50									
140	75	65	45	95	25	55	60									
150	75	75	55	95	25	65	60									
160	80	80	65	95	25	75	60									
170	90	80			25	75	70									
180	95	85			25	75	80									
190	95	95			35	75	80									
200					40	80	80									
210					40	90	80									
220					40	95	85									
230					40	95	95									
240					50	95	95									
250					60	95	95									
260					65	95	100									
270					65	95	110	30	45	95	100	50	30		95	95
280					65	95	120	40	45	95	100	50	40		95	95
290					65	100	125	40	55	95	100	50	45		95	100
300					65	110	125	40	65	95	100	50	55		95	100
310					65	120	125	50	65	95	100	50	65		95	100
320					70	125	125	60	65	95	100	50	65		95	110
330					80	125	125	65	65	95	105	50	65		95	120
340								65	65	95	115	50	65		100	125
350								65	65	95	125	50	65		110	125
360								65	65	95	125	50	65		120	125
370								65	65	115	125	50	70		125	125
380								65	65	125	125	50	80		125	125
390								75	65	125	125	50	80		135	125
400								80	70	125	125	50	65	65	95	125
410								80	80	125	125	50	65	65	105	125
420								80	80	135	125	50	65	65	115	125
430								80	80	140	130	50	65	65	125	125
440								80	80	140	140	50	75	65	125	125
450												50	80	70	125	125
460												50	80	80	125	125
470												50	80	80	135	125
480												50	80	80	145	125
490												60	80	80	145	125
500												65	80	80	150	125

Fig. 3

as to how it is used. In the larger power plants there is usually a trained group of technicians for making the necessary tests to determine the operating characteristics of the boilers, turbines and auxiliary equipment and for making the necessary computations to derive the incremental curves. With this data they prepare schedules of operation for various combinations of equipment showing the total output and how it is divided among the operating units. Figure 3 shows such a schedule. In addition to schedules for individual generating stations, system schedules are set up for inter-connected stations which show in a similar manner how much load should be assigned to each of the stations corresponding to a given system load. These schedules are given to the operating personnel and are constantly followed.

The development of these schedules is only one function of the group following the technical operation of the plants and system. These men are continuously checking and calibrating the instruments on the boilers, turbines, and auxiliaries and making daily records of the operating efficiency of the major pieces of apparatus. Based on these

(*Continued on page one fifty-one*)

CORNELL ENGINEERS

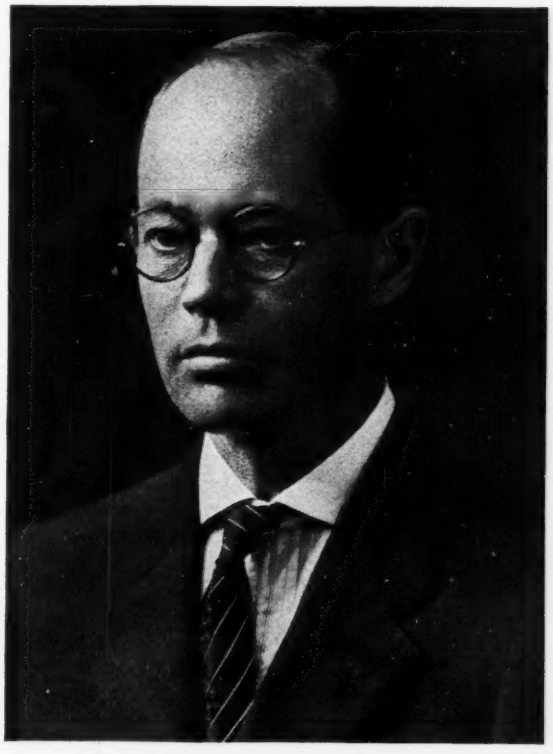
GEORGE BURR UPTON

By Sidney Davidson, ME '36

This purpose in presenting this, the first of a series of biographies, is to better acquaint the students and the alumni with the prominent men of the Engineering faculty. Many of the alumni will recognize some of the older men, but they will also be introduced to a younger group of members who have come up to take the place of those who did so much for Cornell and for engineering, but have departed. These, then, are the men who carry on, as in days gone by, the highest traditions of engineering education here at Cornell.

"I didn't intend to teach, it just happened. It was accidental." The incident that Professor G. B. Upton was referring to occurred towards the end of the school year in 1905. He had returned to Cornell that year on a fellowship in metallography and the University Rules state that a person holding a fellowship must teach if necessary. Thus, when a Mech Lab instructor was fatally stricken with pneumonia, Professor Upton was called upon to teach. He has been with the Department of Experimental Engineering in Sibley College ever since, and now ranks as one of the most brilliant men on the University faculty. On the campus, and wherever Cornell engineers meet, his work is often referred to, but because he is so modest and retiring, very little is really known of him.

Professor Upton was born in Newark Valley, New York, on October 16, 1882, the son of two Cornellians. His ancestry traces back to the Mayflower or within five years of that time. Before he was a year old, the family moved to a small town near Denver, Colorado, where his father took up farming. He lived there until he was seventeen, when he came East to Ithaca to finish his education. Upon graduating from Ithaca High School, he won a State Scholarship and entered Sibley College in 1900. Here he was awarded a University Scholarship. During his undergraduate days, his marks averaged about 90. His classmates gave him the title of 'class grind,' but few realized that he spent many hours each day working his way through school besides carrying extra hours in the Arts College. In his senior year, he was elected to Sigma Xi for research in metallography, a rare honor for an undergraduate at Cornell.



PROFESSOR UPTON

Having received the ME degree in 1904, he returned in 1905 to continue the study of metallography, for which he received his MME at the end of that year. At that time metallography was a new field and required much pioneering. Under the guidance of Professor W. D. Bancroft of the Chemistry Department, Professor Upton made great headway. Furthermore, he was deeply imbued with the keen inspiration toward the rational application of the fundamentals of the pure sciences to engineering with which Dr. Thurston, Director of Sibley College until his death in 1903, had permeated Sibley College and the engineering world as well. As a result, everything he did then, and everything he does now, is in terms of the fundamentals of mathematics, physics and chemistry.

He was making good progress in metallographic research when the fire in Morse Hall in 1916 destroyed his laboratory and all of his research records since 1903. The loss was irreparable and he was very discouraged for a while. Then, before he had gotten over that, he suffered

another setback when he damaged his eyes doing close work with a microscope. Nevertheless, one result of the metallographic study was that the teaching of materials in the Sibley Mech Lab came to include the origins and control of properities as well as their measurements. This in turn led to a parallel reorganization of the Mechanics Department with the result that a department was set up in Sibley College that was more suited to its needs and was entirely separate from the Civil Engineering department which had previously done the work.

About 1912, the development of the automotive option for seniors began under Professor Upton. This, together with the teaching of metallography, has served to take him from the duties of Mech Lab instruction. In 1919, he became a full Professor of Experimental Engineering.

In commercial work, Professor Upton has become highly respected for his abilities and achievements. During the War, he did materials testing for the United States Ordnance Department, and later, worked on the design of airplane engines and mufflers for the National Advisory Committee on Aeronautics. After the War, and also for the N.A.C.A., he outlined the setup and procedure for a very successful test apparatus for use in developing a fuel injection system for Diesel engines.

Since 1921, he has become widely known as an expert witness, patent expert, and consulting engineer in automotive engineering, materials, lubrication and lubricants. He is considered a pioneer and authority in each. He has served General Motors many times; the largest litigation, the Deppee Case in 1925, required two years of experimental preparation and involved $15,000,000 damages. He is frequently called upon by other firms, too, but will not take a case unless he thinks he is on the right side. His success is due to keenly analytical reasoning along fundamental principles and to simple statements of fact, much, he says, as is required of students in engineering.

As an author, his text 'The Materials of Construction,' published in 1915, was far ahead of the times because it attacked the subject from a mathematical and physiochemical viewpoint. Because he disliked writing, the contents, for the most part, were dictated. He has also written about 50 articles in the field of experimental engineering on internal combustion engines, materials, lubricants and lubrication, as well as four Bulletins of the Experiment Station of the College of Engineering of Cornell University. An advanced text in metallography may appear within the year.

In the field of invention, his absolute viscometer and fatigue testing machine are well known to Junior Mech Lab students since 1915. He is now directing the development of a new absolute viscometer which will have a range from the gases to the heaviest fluids.

His hobbies are botany and ornithology, and on sabbatic leaves, he tours the country by auto collecting specimens, while at the same time recording the percents of grade climbed, mileage, etc.

His most valuable traits are the ability to inspire others and his intellectual honesty. By the latter is meant that he never attempts to explain something unless he understands it. Instead, he throws up his hands and says characteristically, "Well, I don't know." He enjoys imparting information to others, yet well-informed as he is, he does not hesitate to ask for other people's opinions to see if theirs concur with his. Small and slightly built, he makes up for what he lacks in physical endowment with seemingly unlimited mental energy. He is modest, retiring and charitable, and an excellent speaker, posessing a natural wit and humor, when called upon. He is a master of several languages and has read widely. Analytical research occupies much of his time, but he also directs active research. His lecture notes are rewritten each year and generally, his thoughts are well in advance of his contemporaries.

Besides Sigma Xi, he holds memberships in Tau Beta Pi, the ASTM, the SAE, the ASME, and he is a frequent contributor to the Transactions of the American Society of Metals.

Professor Upton, more than any one else, has been able to take up where Dr. Thurston left off and reach still loftier heights. He is a brilliant and inspiring teacher whose experience has covered the shift in engineering from the purely empirical methods of 1900 to the highly applied science of today. For the future, he sees unlimited opportunity for the engineer in providing for the satisfaction of human wants, for he believes that in place of geographical frontiers, we shall have technological frontiers, and that there will be no end to that. He sees no immediate runout of liquid fuels, but thinks that the rapid development of the automobile has gotten ahead of the road system, and the ability of humans to use them. There is also, he thinks, no point to the development of low wind resistance cars since there are no roads on which to use them. Finally, he believes that the solution to economic problems lies in the application of engineering attitudes towards the collection of sufficient data for a fair answer. To this end, he thinks that the Administrative Engineering course may develop a group of such men who, taking their economic problems seriously and working for the most good, and not toward political ends, may find a solution.

CORNELL SOCIETY of ENGINEERS

EDWARD C. M. STAHL '13, PRESIDENT

J. D. TULLER '09, VICE PRESIDENT — S. C. HOLLISTER, VICE PRESIDENT

EDWARD B. KIRBY '25, RECORDING SECRETARY — JOHN P. SYME '26, SECRETARY AND TREASURER

"The objects of this Society are to promote the Welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Column

Fellow Engineers:

As we are primarily citizens of the United States and then citizens of our respective states, so are we first Cornellians and then engineers. In general, however, when external matters are not involved, we are primarily interested in our more immediate association and consequently give more attention to it. In our undergraduate days, many of us were entirely unaware of the interrelationship between the College of Engineering, the other colleges in the university and the management of the university. With the exception of a few practical subjects in our freshman year, our studies were almost entirely in the college of arts and sciences where our mathematics, physics and chemistry were taught without any designed correlation with the engineering courses to follow. This was also true of economics and any other basic courses taken in the Arts College. More recently there have been some measures taken to modify these courses for engineers so that they will emphasize more clearly the information and problems which will be useful in the later engineering curricula. This, of course, has been brought about entirely through cooperative effort as each College Faculty under our system of academic freedom is privileged to determine what and how to teach. This is as it should be in principle, but when one college is entirely dependent on another for its basic tools, it is only fair that its requirements be considered by the other. Fortunately this attitude is now in evidence and its continuance and growth will be of great benefit to the undergraduates. This, while of immediate importance to the student and of interest to the alumni, is only a small part of the situation affecting the Engineering College.

The management of Cornell University is vested in a Board of Trustees composed of thirty persons. Fifteen of these are elected by the Board itself, ten elected by the alumni of the University and five appointed by the Governor of New York. Each member serves for five years. The President of the University and eight other persons are Ex-officio members. These eight are the Governor of New York, the Lieutenant Governor, Speaker of the Assembly, the Commissioner of Education, Commissioner of Agriculture, the President of the State Agricultural Society, the Librarian of the city Cornell Library; and the eldest male descendant of Ezra Cornell for the term of his natural life. Two trustees are chosen by the alumni each year and are elected by mail ballots. In visualizing the foregoing organization of the government of the university, it is very evident that the alumni have a direct and important influence in the management of the university and one which should be exercised thoughtfully and conscientiously each year when the ballots are sent out.

In order to have a well-balanced University, no one college should be neglected in its essential equipment or in the circumstances that will attract and hold outstanding educators in its field. Our College has been fortunate in the eminent and self-sacrificing men who have carried on in the face of discouragement and sent out high grade and competent engineers. But what of the future? We engineers must become more articulate in the councils of the University. Many of us know personally members of the Board of Trustees and at every convenient opportunity the needs of our college should be discussed with them—not that these needs are not known to them, but to encourage them by the knowledge that there is a large body of men vitally interested and active in the rehabilitation of the physical plant and in the welfare of the Engineering Faculty. It is well for us to remember that the University was chartered with the express purpose of emphasizing the mechanic arts, in order to promote the liberal and practical education in the several pursuits and professions. This means more than perfunctory attention to the Engineering College.

Not only does every person holding a Cornell degree have the privilege of voting for two trustees each year but ten such Cornellians may place any person in nomination by petitioning the Treasurer of the University. It is perhaps well for us also to reflect on these matters when we wonder what can be done constructively to help our own college of engineering. Whatever strengthens the reputation of Cornell Engineers reflects honor and credit to the University as a whole.

Sometime in April the ballots will be sent out and every one receiving a ballot should exercise his privilege of voting and carefully weigh his choice among the candidates.

EDWARD M. STAHL, *President*

THE CORNELL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR

PUBLICATION BOARD

W. J. Weakland, Jr., '36 CE., *Editor-in Chief*

H. T. Critchlow, Jr. '36, ME., *Managing Editor* — O. A. Jillson '36, ME., *Business Manager*

J. C. Delibert '36, CE., ... *School Editor*
F. R. Fowler '36, ME. ..... *Alumni Editor*
C. H. Leet '36, EE. ..... *Assistant School Editor*
A. W. Folsom '36, CE. ..... *Assistant Alumni Editor*

R. W. Baunach '36, CE. ..... *Circulation Manager*
R. Reis '36, AE. ..... *Advertising Manager*
D. P. Keel '35, CE. ..... *Local Advertising Manager*
E. S. Rosenblum '36, ME. ..... *Assistant Circulation Manager*

Miss B. Slocombe '36, ME., *Associate Editor*

JUNIOR BOARD

P. D. Carter '37, ME. ..... *Editorial*
G. Kaye '38 ..... *Editorial*
J. G. Machemer '37, CE. ..... *Editorial*
G. Philipp '37, ME. ..... *Editorial*

T. C. Rehm '37, EE. ..... *Editorial*
T. B. Kelley '37, ME. ..... *Business*
J. R. Wandling '37, CE. ..... *Business*
J. Schadler '37, AE. ..... *Business*

ADVISORY BOARD

School Directors	*Faculty*	*Alumni*
Prof. H. Diederichs	Prof. W. N. Barnard, ME.	F. A. Barnes '97, CE.
Prof. S. C. Hollister, CE.	Prof. M. G. Malti, EE.	R. E. Clark '13, ME.
Prof. P. M. Lincoln, EE.	Prof. J. E. Perry, CE.	J. P. Syme '26, ME.

❖ EDITORIALS ❖

MEANING OF HONORARY SOCIETIES

The time of year is at hand when the various honorary engineering fraternities will be announcing the election of new members,—the bestowal of recognition on those who have labored long and hard during their years here, who have taken a clean, healthy interest in their work, their school, and in all the activities of the University. It might be wise to pause for a moment's reflection and ask: "What is the meaning of election of these societies?"

No fault can be found with the type of men who are now being elected to our engineering societies. By far the great majority of them are students who well merited the recognition. Ability and achievement, not friends and politics, are the means by which most men receive these honors. But where fault *can* be found, and serious fault it is, is that almost without exception, these societies have come to be looked upon as ends in themselves. They are considered a just reward for hard work, for participation in activities, for the development of well-rounded personalities. Almost instinctively, the news of one's election is received with the mental exclamation: "Thank God! I made that one!" And immediately our struggles seem to be over: We have reached the engineers' goal, we have made our honorary society.

No greater error could be made. Surely we should feel joy at the news of our election, and most certainly we should be humanly proud of the fact that our achievements have won recognition. But our reaction stops there, our honorary societies will become little less than mockeries, small groups formed to honor one another, and to smugly bestow compliments and plaudits on bright youngsters. Greater than the honor which it brings, election to an honorary society, especially in engineering, brings with it serious obligations. If we are to display the key of our society, if we are to be known as members of it, then it behooves us to try to live up to the ideals of our society to the utmost,—more so after election than before, and more so after graduation than before. But all too often, the aims and ideals of these societies, as expressed in their rituals, are looked upon as something very lofty, something very noble and desirable, yet something which cannot possibly be achieved in practice. We do noble lip service to our ideals, but fail them when it comes to the actual test.

Civilization today is to a very large extent dependent on the engineer for its furtherance and maintainance. On his integrity, faith, and idealism, depend the lives of thousands, and the continuance of life at its present scale. If we are to be worthy of this trust, if we are not to fail, we must develop within our profession men of the greatest integrity and highest ethics, men proud of their profession and its accomplishments, and men keenly interested in its betterment. And every man elected to an honorary society should feel it his personal obligation to seek after these goals once he has entered practice.

This then is the meaning of election to an honorary society—not that we are great men, or highly superior to our less fortunate classmates, but rather that somewhere within us the spark of devotion to our profession and to its ideals has been found shining, and our election is a mandate to go out and strive for those ideals with all our sincerity and devotion.

EXEMPTIONS

Exemptions, as practised by the College of Engineering, have caused much comment lately from all parts of the campus. Some declare that this privilege, so dear to the hearts of the engineers themselves, is detrimental because it prevents the student from getting a final review of the subject and completely digesting the work he has gone over during the term. This is especially true of

those courses given in the mechanics department. A student can get a hold of some old prelims, study them problem by problem, and usually get a fair mark in the prelims since the problems do not greatly vary from year to year. If at the end of the term, his average is above a certain standard, he is exempt from the final examination. In all probability unless his retaining power is exceptionally good, he will forget a great deal that he learned in his cramming sessions before the prelims. When the course is over, he can but say that he was exposed to the material, since his time was mainly given to specific problems and not to the basic principles themselves.

Taking these points into consideration, it would seem that something is lacking to give the student a more complete understanding of the subject. In many courses throughout the different colleges a final report is required. Why not try this in our own school? Of course subjects like Mech Lab would not fall into this requirement, since the exemption from such courses is already based mainly upon report writing. This system would give the student, whose studies come hard at first but who can later see and apply the basic principles, a fair chance to better his mark. This only seems fair since it is such a student who has received the most from a course and is probably one reason why some engineers whose work in college is not exceptional, are so successful in practice.

In writing a final report, the conditions are the same as those encountered in actual application of the engineering principles. The student is at liberty to express his own theories and ideas on a certain part of the course in which he is especially interested. This is a very valuable asset to any student and is not possible under the present examination system. All references are at his disposal, and it is not necessary to memorize a number of constants and values which will be quickly forgotten after the examinations are over. The student will be able to give a complete analysis of the whole course, leaving out many of the minor technicalities which during the school year seem to so greatly affect his grades. In the long run, the object of any course is to teach the basic principles so that they may be understood and used in another study which is more advanced. This is the fundamental difference between a liberal arts course and a professional education. This purpose is entirely defeated it the student crams for the less important points and completely misses the digestion of the course as a whole.

—o—

INTERFRATERNITY COUNCIL

For several years past, the organization of the interfraternity council has been such as to make it effective and unrespected. This was due, partially, to the lack of a working constitution, and also the lack of interest and ability of members to ferret out and attack problems needing solution. It was no disgrace for a fraternity not to be a member of the council.

However, this year has seen the introduction of a movement which is performing the task of building an effective organization. In the early part of the year a constitution was developed and inaugurated which puts teeth into the decisions which will, and have been, handed down by the judiciary committee. Later a rally was sponsored for the football team on the eve of the Penn game, and just recently a seven page questionaire has appeared which was sent to all the member fraternities. This questionnaire covers, through short questions, problems pertaining to; finances, rushing, social activities, scholastic standings, and other miscellaneous points. It marks the beginning of a filing system, which it is hoped will be of use in furnishing information for the solution of future problems.

At the present time, to make sure that the delegates from the various houses are men who have the necessary ability to carry out the future plans, it has been suggested that keys and shingles be awarded to the members. Requiring one of the two delegates from each house be the fraternity president has also been considered.

To these proposals, let us only say that great care must be taken that men are not obtained who are already too busy to carry out the necessary work, still bearing in mind that the more work a man has to do, the more will he do. Moreover, it must be seen to, that in case men of the desired caliber are universally obtained, that plans and schemes of the larger houses are not forced down the throats of the smaller.

As a result of this movement, it is hoped, will come a new spirit, or outlook at least, to fraternity men concerning their obligations to other houses and Cornell, supporting the traditions which have, in the past, made Cornell men proud.

The following note is taken from the column "Letters to the Editor" in the February 20 issue of the "Engineering News-Record." It should be of interest to both alumni and fellow classmates of the students referred to.—Ed.

Sir—There is a very fine group of students from Afghanistan graduating from the School of Civil Engineering of Cornell University this year, who are going back to their own country to work under the heavy handicap of not having an engineering library of any kind in Afghanistan.

There are probably many engineers in the United States who have files of old engineering periodicals, books no longer used, old editions, etc., who would be glad to donate them for such a purpose. A list of such books sent to this library would be used for making up a suitable collection.

The Afghan Minister in London will see to the transportation and to the care of the books as the nucleus of an engineering library, by the Minister of Education at Kabul. M. H. WALBRIDGE,

Librarian, School of Civil Engineering, Cornell Univ., Ithaca, N. Y.

ALUMNI NOTES

'93 CE—Norman B. Livermore of San Francisco, Calif., is a director of the Pacific Gas and Electric Company and also of the Natomas Co.

'96 ME (EE)—Carlos W. VanLaw was recently engaged as engineer in full charge of the Como Mines Co., a Nevada gold and silver mining venture.

'96 CE—Glenn D. Holmes has been retained as Director-Chief Engineer by the Onondaga County Sanitary Sewer and Public Works Commission. His immediate work is the construction of five and one-half miles of 36 in. to 48 in. intercepting sewer. He is also occupied with the plans for a $2,101,420 treatment plant of 4.5 m.g.d. capacity. He may be addressed at Room 109, Court House, Syracuse, N. Y.

'96 CE—The late Robert H. Simpson was one of the recipients of the Rudolph Hering Medal for his work on the paper "Intercepting Storm Sewers and Stand-By Tanks at Columbus, Ohio", at the Annual Meeting of the A.S.C.E. at New York City. Mr. Simpson died May 18, 1933.

'96 ME—Walter S. Goll has retired after thirty-eight years of service as manager of the Fort Wayne plant of the General Electric Company.

'98 ME (EE)—Jeremiah D. Maguire of New York City has been nominated by Governor Lehman as a member of the Interstate Sanitation Commission, a new agency recently created by the present Legislature. Mr. MaGuire recently resigned as president and director of Textile Banking Corp. of New York City.

'00 ME—Henry T. Coates is regional chairman and a director of the coal committee of the National Asso. of Purchasing Agents. His address is 11 West Forty-Second St., New York City.

'02 ME—Charles Young is vice president of both the Pennsylvania and the Long Island Railroads.

'03 ME—Robert C. Fenner is president of the Vortex Cup Company. A merger of this company with the Individual Drinking Cup Co. has been proposed. Mr. Fenner will be president of the new company with assets of $6,000,000.

'04 ME—Francis N. Bard is president of the Barco Manufacturing Co., 1801 Winnemac Ave., Chicago, Ill. This company manufactures railway equipment, flexible ball joints and other steam devices. Mr. Bard is a director of the Railway Business Association and the National Asso. of Manufacturers.

'05 CE—Clarence E. Boesch is head of the board of geologists and engineers appointed by the War Department Corps of Engineers to study geological conditions in the Florida Ship Canal plan.

'05 ME—Thomas F. Crawford is Philadelphia manager for the Elliot Company. His address is care of the Elliot Company, 1421 Chestnut Street, Philadelphia, Pa.

'06 CE—John Stearns is at present directing the construction of a sixty mile aqueduct from the Colorado River to the metropolitan areas of Southern California. He may be reached at P. O. Box 426 Indio, Calif.

'07—William R. Wigley, who has been associated with the Ithaca Trust Company, and later manager of the investment department of George D. Bonbright Company in Ithaca, has become treasurer and a director of William H. Davis and Company, Inc., of Jersey City, N. J. He will retain his Ithaca home at the Cayuga Apartments.

'07 ME—Lee E. Barrows is now managing the production department of the Texas Company in Houston, Texas. He was just recently transferred from Fort Worth.

'07 ME—George C. Estill has been leading a campaign to protect the holding companies. He has written several letters to the senators and representatives of his state, Florida, showing in part the assistance these companies gave to power firms during the hurricane of last Nov. Mr. Estill is president of the Florida Power and Light Company.

'08 ME—David H. Goodwillie who until recently was vice-president of Libbey-Owens-Ford Glass Co., was elected to the city council of Toledo, Ohio. He will serve under the first city manager that the city has had.

'09 CE—George F. Weighardt is hydraulic engineer, for the Hackensack Water Co. in Weehawken, New Jersey and the Spring Valley Water Works and Supply Co. in Spring Valley, New York.

'11 ME—Julian P. Hickok of 315 Zeralda St., Germantown, Philadelphia, Pa., teaches mechanical drawing and mathematics in Simon Gratz High School. He is also secretary of the Philadelphia branch of the Henry George School of Social Science.

'12 ME—Joseph P. Riply is the president of Brown Harriman and Co., Inc., whose offices are at 63 Wall Street, New York City. This firm has recently opened offices in London, Eng.

'13 CE—Harry G. Specht is general manager for the Eastwood-Nealley Corporation, Belleville, N. J. His home address at present is 31 Stanford Place, Montclair, N. J.

'13 CE—Marcel K. Sessler, broker with Orvis Bros. and Co., members of the New York Stock Exchange, recently returned from an interesting visit to Mexico. His office is located at 60 Broadway, New York City.

'14 ME—Robert L. Clause, vice-president of the Pittsburgh Plate Glass Company, has been chosen to the board of directors of the First National Bank of Pittsburgh, Pa.

'12, '15 CE—Domingos G. Borges, who recently was in the United States on vacation has returned to his home in Brazil. His address is % Companhia Fiat Lux, Nictheroy, Brazil.

'14 CE—Joseph E. W. Iglehart is a partner in the banking firm of W. E. Hutton and Co., 52 Wall Street.

'14 ME—Wendell Phillips is mayor of Port Jervis and president of the New York Asso. of Mayors.

'15 CE—MCE '35—Carl C. Cooman is employed by the Rochester Gas and Electric Corporation. He may be reached at 28 Woodrow ave., Rochester.

'16 CE—Wilson T. Ballard was awarded the James Laurie Prize for his paper "Three-Span Continuous-Truss Bridge, Cincinnati, Ohio" at the recent Annual Meeting of the A.S.C.E. held in New York City. At present he is engineer for the Public Works Administration of Maryland and Delaware.

'16 ME—Frank W. Pierce is executive assistant to the president of Standard Oil of New Jersey. His office is in Rockerfeller Center, New York City.

'20 ME—'21 BS—William Littlewood, chief engineer of American Airlines, has recently been awarded the Wright Medal for the outstanding paper on aeronautics for 1935. This medal is awarded annually by the Society of Automotive Engineers. Mr. Littlewood lives at 712 North La Grange Road, La Grange, Ill.

'21 BS—'21 ME—Edward Rich, jr. is the president of one of the largest laundry businesses in the city of Baltimore, The Sanitary Laundry Co.

'22 ME—C. C. Kwang has for the last two years been connected with the National Economic Council—dept. of engineering research and planning. The headquarters of this council is located in Shanghai. Mr. Wang may be reached % Rho Psi Fraternity, 160 Hwa Kee Ave., Bubbling Well Road, Shanghai, China.

'27 Ph.D.—Dr. Shu tien Li is now president of Pai Yang University in Tienten, China.

'27 CE—C. Herbert Moore is associate engineer on the Conchas Dam project. His address is W. S. Engineers Office, Tucumari, New Mexico.

'28, '29 E. E.—Among those who have made the fatal step are Norwood G. Wright and Margaret L. Reed, who recently married and are living at 531 Park Avenue, Barberton, Ohio. Wright is testing engineer at the Ohio Brass Company and is also actively interested in Boy Scout work.

'29 CE—John Hedberg has returned to the faculty of Stanford University as assistant professor of Civil Engineering after having served one year in the United States Bureau of Reclamation at Denver, Colo.

'29 CE—Edward C. Collins is the assistant steward at the Belmont Hotel in Bermuda.

ME '31—W. J. Hudson has the Wisconsin territory for Combustionaid a device for intermixing the gases in furnaces by introducing highly preheated air. His office is at 611 N. Broadway, Milwaukee.

ME '31—D. A. Fisher is supervising the inventory system of the Bronx Gas & Electric Company, New York.

ME '31—R. L. Hill, Jr., is selling refrigeration, air conditioning, and dairy equipment with the York Ice Machinery Corp. at Washington, D. C. His home address is 5310 Reno Ave., Wash.

ME '31—W. G. Ford is calculating in the Turbine Engineering Department of the Elliot Company at Jeanette, Pa. He may be addressed at 219 N. First St., Jeanette.

ME '31—H. C. Garretson Jr., is a First Lieutenant of the Organized Reserve Corps and is on active duty with the CCC at Camp Charles M. Smith, Waterbury, Vt.

ME '31—R. L. Gibson, Jr., is an Apprentice Pilot with Pan American Airways, Inc., at Miami, Florida.

ME '31—P. S. Gray is selling machine tools, mill supplies and power plant equipment for the H. S. Gray Co., Honolulu. He may be found at 33 Dousett Ave., Honolulu.

'32 EE—W. R. MacDonald, Jr., who has been on the publication staff of the American Institute of Electrical Engineers, since 1934, is now an Editorial Assistant on Electrical Engineering. While at Cornell, he specialized in electronics and communication, building up a radio service and repair business after graduation, which he carried on until he joined the A.I.E.E. staff.

'32 MCE—Warren E. Wilson has recently been appointed an instructor in Civil Engineering at the South Dakota State School of Mines, at Rapid City, South Dakota. Wilson graduated from Lehigh University, received his master's degree from Cornell University, and has now completed all of the residence requirements for a doctor's degree at the California Institute of Technology.

'33—Benjamin T. Babbitt, Jr. is engaged on topographic mapping with the U. S. Geological Survey at Sacremento, California. He may be found at 1217 Fifteenth St., Sacremento.

'33 ME—Robert B. Hyde has invented an apparatus called a gasostat which is designed to relieve fatigue of driving by the use of a hand throttle. Mr. Hyde's office is 250 Hill Building, Syracuse.

'35 EE—Sherman G. Forbes is employed in the General Electric Co., in Schenectady.

'35 EE—J. B. Maggio has a Fellowship in the School of Engineering, Harvard University of which he is availing himself at the present time.

'35 EE—A. C. Prescott, has just completed the graduate student training course with the Westinghouse Electric in Sharon, Pa., and is now in the Voltage Regulator, a section of the Transformer Engineering Department.

'35 EE—F. G. Miller, is in the turbine room of the Harriman Station of the New England Power Company. He states that he is gaining considerable basic experience here but hopes to transfer to the meter department.

COLLEGE

M.E. CURRICULUM CHANGED

The modern industrial developments seem to be having a marked effect upon the School of Mechanical Engineering. Beginning with the class of 1938 the regular ME curriculum has been changed so as to make it more scientific and less administrative. This was done by dropping out the second term of economics, and putting advanced strength of materials and accounting into the sophomore year. The course on differential equations has been moved up into the junior year along with a new course on fluid mechanics. After glancing over the schedule for the junior ME's, everyone seems to be of the opinion that that year will be the most difficult one experienced.

Also, two new options were added last year to the five already existing ones, namely; power plant, industrial, automotive, aeronautical, hydraulic divisions of the school. The first of these new options was the air-conditioning course offered under the supervision of the heat power department. This course, while it will teach the student engineer the principles of air-conditioning, does not aim at this field as a single goal. The actual aim of this course is to teach the basic principles of fluid flow, heat transfer, refrigeration, and properties of mixtures. This enables a graduate of this course to apply his knowledge to a great variety of fields dealing with these subjects, but he will also have a very good basic training in the field of air-conditioning.

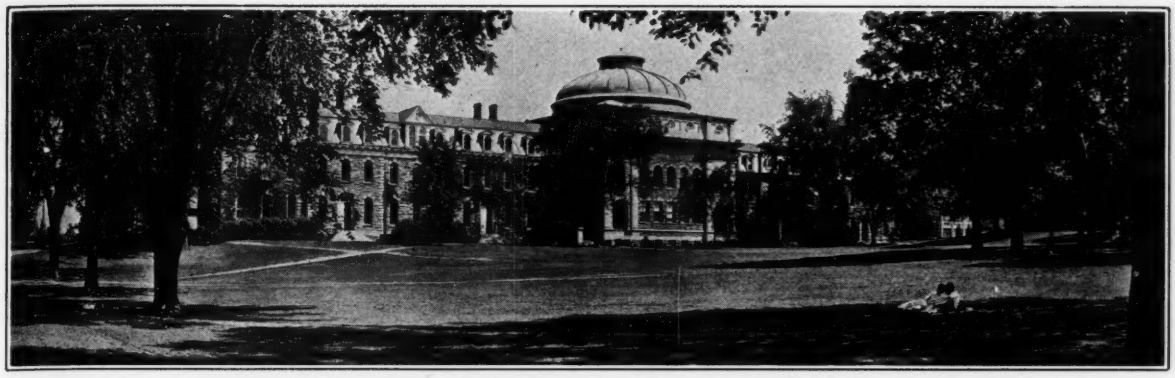
The latest option has been offered by the department of experimental engineering under the direction of Prof. Davis. It will be known as the metallurgical option. The complete arrangements for this course have not been finished as yet, but they are hoping to extend it to a five year course leading to the degree of metallurgical engineer. At present this curriculum puts such courses into the engineering program of studies as applied metallurgy, 3X52, physical chemistry, 405, physical chemistry lab, 410, analytical chemistry, 201, introductory metallurgy, 545, chemistry of solids, 435, and furnace metallurgy. This is becoming a larger and more important field every year. Several years ago only those companies dealing directly with the production of engineering metals required the services of a metallurgical engineer. Today, on the other hand, we find that almost every company having to do with production or elmentary fabrications of machinery has one or more trained metallurgists in their employ, depending upon the size of the plant. This option will first be open to the members of the class of 1938 and should prove a very popular course.

—o—

SIBLEY SMOKER SUCCESSFUL

Following closely on the heels of other smokers in the College of Engineering, three societies of Sibley College, Atmos, Kappa Tau Chi and the American Society of Mechanical Engineers, in cooperation with members of the faculty sponsored a smoker on Friday, February 21, for all students in the M.E. and A.E. schools and underclassmen in E.E., thus including all students who were not invited to previous affairs. The primary objective was to afford both faculty and students an opportunity to become better acquainted with each other and to bring about more cordial relations between the two.

The smoker was unique in that it featured a faculty-student basketball game. When the faculty line-up was printed in the Sun earlier in the week, it carried the name of varsity basketball Coach H. B. Ortner. This didn't pass unnoticed for shortly after a caustic letter appeared in the Sun, written by "An Engineer," and stated that the faculty was resorting to foul practice in bringing in a "ringer" at Cornell where the highest athletic standards have been maintained. The next day, Oshun Lyner '07, Graduate Manager of Sibley Faculty Athletics, in behalf of the faculty, replied that not only would Mr. Ortner have to be used, but due to sabbatical leaves, high blood pressure, old age and better offers from other schools and industrial organizations, it would be necessary to use Walt Head as stationary guard and Rym Berry as coast defense in place of some of the regulars.



NOTES

On the night of the smoker, more than 200 students and faculty members gathered in the Old Armory. The first half was hard fought and evenly played with Mr. Moynihan and Prof. M. G. Northrop doing most of the faculty scoring. Mr. Ortner was not present, having gone to Philadelphia with the varsity. The student team, which consisted of players of the regular M.E.-E.E. league team, played aggressively; Dan Moretti and Jim Ferris accounted for most of the points. An intermission followed during which congenial Dean-Emeritus 'Uncle Pete' Smith gave an interesting story of the early crew days at Poughkeepsie; it was greatly appreciated. He was followed by Gus Winans E.E. '36, who filled in with several selections on the accordian.

In the second half, the faculty were determined to forge ahead but were stopped by laughter when Wiitanen, one of the players on the student team, appeared on the floor in winter underwear, galoshes and ear muffs. When play was resumed, Mr. Goodman of the Mech Lab department found it necessary to invoke the aid of a ladder to assist the faculty in their uphill fight. The final score, even after the Sibley constant had been used, showed that the students were ahead.

Later the enthusiastic crowd gathered around one corner of the Armory where Rocco Vittucci M.E. '36, presented a musical story on the fife of "How the Engineer Busted Out." Following this, the committee, with the assistance of Cliff Warren and C. N. Mellowes, presented a burlesque in five acts of some idiosyncrasies of several members of the faculty. The audience had no difficulty in recognizing the characters selected. Mr. Goodman then gave a side-splitting monologue, with actions, entitled "The Chinaman Learns to Skate on Beebe Lake." Dean Kimball concluded the evening's program with a short talk in which he told several amusing anecdotes besides commenting upon the good that is derived of social functions. He also expressed regret that Director Diederichs was unable to attend due to illness.

D. C. Amsler, president of the A.S.M.E., was master of ceremonies for the evening. The committee in charge consisted of D. C. Amsler, P. D. Carter, S. Kellogg II, D. F. Macbeth, A. S. Schultz, S. Davidson and J. G. Dobson.

Faculty	Students
L.F.—J. R. Moynihan, Capt.	D. D. Moretti, Capt.
R.F.—C. O. Mackey	N. J. Ferris
C.—M. G. Northrop	R. W. Kunkle
L.G.—L. F. Welanetz	C. R. Otto
R.G.—H. L. Goodman	J. J. Amado

Substitutes: Faculty—S. F. Cleary, H. G. Barone. Students—W. Wiitanen, J. E. Buxton, J. P. Bracht, E. J. Shapiro, J. Larlee.

TAU BETA PI ELECTS

The following men have been elected to Tau Beta Pi, honorary engineering scholastic society: Asa George '36, M. P. Matthew '36, P. D. Carter '37, L. A. Christensen '37, K. B. Earnhardt '37, J. C. Forbes '37, D. T. Houpt '37, R. A. Krider '37, R. G. Luburg '37, F. S. Macomber '37, A. V. Mathey '37, W. H. Peter '37, P. R. Scofield '37, J. J. Serrell '37, and W. G. Stolberg '37.

CHI EPSILON ELECTS

At a dinner meeting in the Hotel Victoria on March 2, Chi Epsilon, National Honorary Civil Engineering Fraternity, elected the following men to the society: Mr. Forrest Milton Towl C.E. '86, M.C.E. '36; Keuneth B. Earnhardt '37, Norman E. Schlenker '37, John F. Stephens '37, Howard V. Hawkins Grad., Ching Ying Ling Grad., Arthur V. Peterson Grad., Harry W. Tobey Grad.

Mr. Towl's election as chapter Honorary Member was in appreciation of his long and outstanding work in Engineering, and of his keen interest in and activity on behalf of, research in Engineering.

These new members will be formally initiated into Chi Epsilon at a Banquet on April 7. John McManus and Alfred Crew III are the committee in charge of arrangements.

STRESS and STRAIN

At last, after many months of diogenean searching, we have stumbled upon the vast underlying difference between those two bitterly opposed factions of modern science, physics and engineering, and we hereby present to you the fruits of our untiring efforts in hopes of broadening your outlook upon this phenomenal situation

The physicist claims that an inch, by definition, is that given length of thoriated tungsten wire, .0563 millimeters in diameter, which when heated in argon to a temperature of 1535.35 degrees centigrade, in an evacuated atmosphere of 5.54 centimeters of spectrosopicly pure mercury, by a current of pi amperes, will emit 8.965×10^{10} electrons per second, the measurements being taken under standard conditions. A renown professor has determined this length accurate to seventeen decimal places.

The plodding engineer on the other hand defines his inch as the distance between the first and second joints of his left forefinger.

* * *

A man from New York was looking into the depths of the Grand Canyon—"Do you know," said the guide, "it took millions of years for this great canyon to be carved out?"

The man was tremenduously impressed. "You don't tell me," he commented, "why I didn't know that this was a government job."

—Pup

* * *

At one of the frosh Hygiene lectures Dr. ——— was discussing at some length the evils of alcoholic beverages. He illustrated thusly: "If you give a donkey the choice of drinking a bucket of water or a bucket of beer, which will he choose?"

At which climax the proverbial voice from the rear of the room shouted out, "The water of course."

Hoping to quell the disturbance, Dr.——— ventured the question: "And why, my good sir, did the donkey choose the water?"

In quick retort came the heckler's voice: "Because he's an ass."

* * *

ENGINEER'S WHISKEY TEST

Connect 20,000 volts across a pint. If the current jumps it, the product is poor.

If the current causes a precipitation of lye, tin, arsenic, iron slag and alum, the whiskey is fair.

If the liquor chases the current back to the generator, you've got good whiskey.

—Pelican

The lecturer was giving a lecture on South America, illustrating it with motion pictures which he had taken himself. A map appeared on the screen; in familiar fashion a small airplane went from city to city, leaving a dotted line as a trail.

From the rear of the room a voice asked: "Doctor, were you on the plane?"

The lecturer who had made that trip by air replied: "Yes, why do you ask?"

"Well then, would you please tell me who was dropping the stones?"

Punch Bowl

* * *

The Japanese proudly announce that they have a thousand men who are willing to drive torpedoes at the risk of their own life. We have several million who are willing to drive autos.

Punch Bowl

* * *

Bridegroom: "I thee endow with all my worldly goods—"

His father: "There goes his bicycle."

* * *

Webster says that taut means tight. I guess I've been taut quite a bit in this school.

* * *

The Devil and St. Peter made a contract to maintain the wall between Hell and Heaven. The first time a hole appeared in the wall St. Peter mended it. Presently another opening appeared. It was the Devil's turn to repair it but still the hole went unrepaired. Finally St. Peter's patience was exhausted. He dispatched a messenger to his Black Eminence and demanded to know the reason for the Devil's delinquency in repairing the wall. The messenger was ignored and St. Peter's ire was really aroused. This time he went in person.

"Satan. said he. "How come the wall has the hole still in it. Don't you know that it's your turn to fix the wall?"

The Devil replied, "I'm awfully sorry but Im too busy now. Fix it yourself."

St. Peter could hardly find words. "You—", he spluttered, "I'll sue you, that's what I'll do."

Came a smile of malice from the Devil, "Where are you going to find any lawyers?"

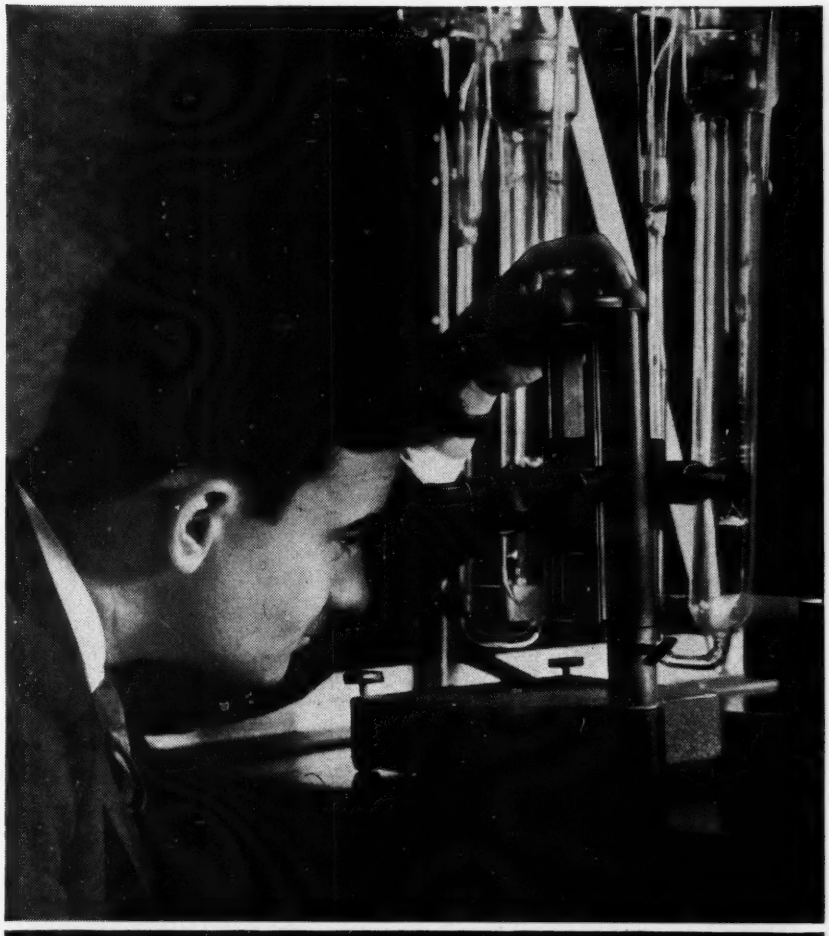
* * *

HEARD IN THE TOWER

Room-mate: "Hey, Tom, wake up! There's a guy in your room stealing your clothes!"

Second ditto: "What d'ya want me to get up for? You two just fight it out among yourselves.

(*Continued on page one hundred fifty*)



"Assets in the making"

THE work of Bell Telephone Laboratories might well be called "assets in the making." It deals with many problems whose solution will be of great future value to telephone users. ¶ The truth of this statement is indicated by improvements already developed and now in daily use. The convenient handset telephone, the dial system, new magnetic alloys, overseas and ship-to-shore radio telephony are just a few examples. ¶ Today more than 4000 men and women are carrying on this work to make tomorrow's telephone service still better.

Why not telephone home at least once each week? For lowest rates to most points, call station-to-station after 7 P.M. daily, or any time Sunday

BELL TELEPHONE SYSTEM

BROWNING, KING & CO.
CLOTHIERS AND FURNISHERS

Step Out in a New Spring Topcoat

We're as ready as the first robin with the new correctly styled Spring 1936 topcoats in raglans, balmacaans, reversibles and double-breasted models with full or half belt . . . in imported and domestic tweeds, covert cloths, camel's hair, whipcord and gabardines. Princes range from

$35 to $65

BROWNING, KING & CO.
ESTABLISHED IN 1822

STRESS and STRAIN

(*Continued from page one forty-eight*)

And then there is the story of the frosh, who, fearing himself in no little danger with respect to his calculus, went and laid down ten hard-earned dollars for the purpose of acquiring some tutoring in said calculus; but when the exempt list was announced, lo, his name led all the rest.

Queer tales come from the sea and life among sailors, especially about zealous captains. Captain Tate was one of these, and when the mate failed to appear on the deck for the second day in succession as a result of his cups, an entry was made in the log recording the fact by saying, "The mate was drunk today." Of course, when the mate saw the entry he boiled over, demanding that the entry be removed, but maritime law made it of no avail.

Several days later, the captain was ill, and the log entry was left to the mate. The next day, when the master appeared on the bridge, he was horrified to see that the preceding entry noted: "The captain was sober today."

* * *

One of the highspots in R. R. 260b was struck recently during a discussion about finding the volume of earth-works. In most courses in which there are both prospective Civil Engineers and Architects, there are two two equally correct ways of doing a given problem: that used by the engineers, and that by the architects (even if they are the same, they are still two methods.) In the discussion mentioned, an engineer was asked about his method, and being the first, he gave an undisputed formula. That made it rather hard for the architect, who was asked about his method, but after a moment's hesitation he gave a more practical answer—"Guess."

* * *

As you look through the humorous section of any engineering publication in this modern day and age you are very surprised indeed if your eyes don't run across the engineer's comical but threadworn tale of the misplaced decimal point. With this point in mind we will proceed to tell a slide rule joke to end all slide rule jokes.

It seems that Joe Bush, an enterprizing young engineer, after several months of experimenting and painstaking labor, had perfected what he considered to be a perfect automobile. At last he was to harvest the reward of his masterful effort. The day of the first trial had come. To Joe's great astonishment and amazement, as the power was turned on, the car, instead of performing its normal function proceeded to turn handsprings and to set upon a neighboring pile of potatoes, peeling them with great proficiency to the accompaniment of a noise that sounded like a regiment of skeletons doing a tap dance on a tin roof during a hail storm. When the chaos had finally spent itself and normal living conditions once more set in, peering over the edge of his slipstick, Joe was heard to mutter something about a decimal point.

CONTROL AND EFFICIENCY OF PRODUCTION

(*Continued from page one thirty-eight*)

records the maintenance schedules for the equipment are prepared so that all operating equipment is continually maintained within a few per cent of test efficiency. That this procedure results in very high continuous efficiency may be readily seen from Figure 4 which shows the com-

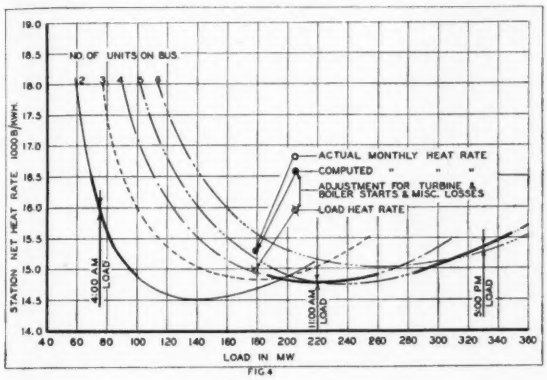


FIG. 4

puted characteristics of a large power plant under several conditions of operation, its load characteristics for a month, and the actual monthly efficiency as compared to the computed efficiency for the month under its load cycle.

From the theoretical aspect there are innumerable combinations of boilers and turbines in a large system so that the development of schedules for all conditions is a practical impossibility for fortunately the number of actual operating conditions and combinations boil down to relatively few. However, in conjunction with the various studies that have been made, mechanical and electrical instruments have been devised which will immediately indicate for any total production the correct assignment for the individual pieces of equipment in actual operation.

The whole purpose of this discussion has been to bring out the fact that a useful tool has been taken from the realm of speculative mathematics and applied in a very practical way to daily production processes which vary continuously and widely from hour to hour. The application of this process in power plants may be traced back directly to the principles, training and inspiration received in the Cornell Mechanical Laboratories under the guidance of Professors Carpenter and Diederichs.

Merely to give abstract credit to the source of inspiration may be very gratifying to our faculty but the fact remains that some concrete recognition of the ultimate value to industry should be made in order that our college of engineering may continue to imbue coming engineers with the same keen love of accomplishment that the graduates have carried away with them.

There is one way that each one of us can help in this matter and that is to be alert in our various personal contacts to recognize individuals who may be inclined to provide endowments to perpetuate their own influence in the field of engineering by contributing to our college of engineering.

PRINTING

Only one high-class standard. Type, paper and ink are put together in pleasing combinations in our shop to meet your special needs. The best at prices you can afford to pay.

We are equipped to print any quantity from one to a million on short notice.

STOVER
RIGHT AND ON TIME
PRINTER
115-117 North Tioga Street

At your service with the best quality of Food--

SHELDON COURT RESTAURANT
412 College Ave.

TIME-SPACE PHOTOGRAPH OF THE FIRST ARCHITECT

'Tis said that in ancient times, architects were also builders. This arrangement it seems fell into ill favor later on, because the architect had no one to blame if things went wrong.

ARCHITECTURE

TIME-SPACE PHOTOGRAPH OF THE FIRST ARCHITECT
(At work)

26th Century B. C.

We asked our (*Time-Space*) photographer to get us a good glossy photograph of the first architect, and this is what he turned in. The photograph shows the architect actually working, and this leads us to doubt the authenticity of the picture; but we will have to accept it because architects may have done some work back in 25,000 B. C.

You can see by the tense expression on this old worthy's pan that he is trying to figure out a way to build in that den off the library, and that extra cupboard in the kitchen, both of which were suggested (too late) by his client's wife.

Nothing like a good photograph to clear up any doubts which might exist about the methods of early builders.

"Use More and More Good Pictures"

Ithaca Engraving Co.
SENECA and TIOGA

ABOUT CROSS SECTION PAPER

Of course you use our cross section paper but we thought that you might like to know—
That this paper is printed from plates of the highest quality and accuracy in a local printing plant.

That a special ink is used and the printer is specially trained in producing this paper:
That we use only 100% rag content paper with a special finish.

And that is why we ship our paper to all sections of the United States and Canada and why we have supplied many large firms with their requirements for many years.

The Cornell Co-op
Opposite Willard Straight

CORNELL ENGINEER

LINCOLN HALL
CORNELL UNIVERSITY
ITHACA, N. Y.

A publication for advancements in engineering as well as student news and activities.

Subscription $2.00

Special Student Subscription $1.00

Individual Copies 25c

If it's

Printing!!

think of

Norton's

PHONE 9451

Our Representative Will Call

Norton Printing Company

317 East State St. - Ithaca, N. Y.

Opposite STRAND Theatre

LUFKIN

TAPES AND RULES

for every Measuring Requirement

Durable and Reliable

All standard patterns including those especially designed for Engineering, Surveying, Construction, Mine, Highway and Railroad work.

Send for Catalog

THE LUFKIN RULE CO.

Saginaw, Mich., U. S. A.

106-110 Lafayette St., New York

Traditional Quality *in* Solid Silverware

For one hundred and twenty-one years the name Kirk on sterling silverware has been a stamp of approval, identifying the maker and the worthiness of every article on which it appears. Quality in Kirk Silver is a tradition of the past and a fact of the present.

Essential Flatware Pieces in the

Kirk Repousse, the Original Repousse

6 Knives	$13.50	6 Forks	$16.50
6 Teaspoons			8.00
6 Salad Forks			10.50
6 Butter Spreaders			9.00
6 Cream Soup Spoons			10.50

Complete Catalog Mailed On Request

R. A. Heggie & Bro. Co.

Jewelers

Phone 2277 **136 E. State St.**

THE BIGGEST SELECTION

THAT HELPS!

THE HIGHEST QUALITY—

THAT'S EXPECTED!

THE LOWEST PRICES—

THAT'S US!

Ithaca Liquor & Wine Co., Inc.

134 West State Street Phone 2625

Just down past the State

Daily—9:00 a. m.—10:00 p. m.

Saturday—9:00 a. m.—11:00 p. m.

G-E *Campus News*

LET SCIENCE ARBITRATE

In heated arguments of this kind, the color analyzer is the court of last resort. Recording photoelectric spectrophotometer is the official name of this device, which was recently exhibited at a scientific meeting at St. Louis. It recognizes an infinite variety of hues and shades; it distinguishes differences in color too slight for human eyes to detect; it automatically records the exact color prescription.

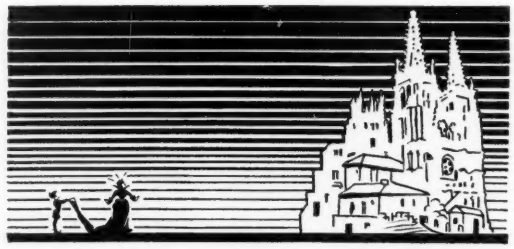
The spectrophotometer is proving especially useful for standardizing the color specifications of inks, dyes, paints, paper, and textiles. It makes obsolete such vague descriptive names as blue-black, blue-white, and yellow-green, and substitutes carefully drawn graphs extending over the whole visible spectrum. The operation of the device, which is automatic, depends upon an ingenious combination of a phototube and thyratron tubes with a precise optical system.

The previous method of making exact color measurements required hundreds of tiresome readings and consumed most of a day. The recording spectrophotometer produces a curve of comparable accuracy in three minutes.

DIG HERE

In the old days, a mysterious individual, called a dowser, with a forked devining rod of witch hazel, used to be called in to locate lost articles buried in the earth. A new magnetic detector, recently developed in the General Engineering Laboratory of the General Electric Company, is now substituting science for magic and hocus-pocus. With uncanny accuracy, it is tracking down lost pipe lines.

Water and gas pipes are often lost because old surveys are inaccurate or because records have been destroyed. Digging up a whole street, in order to find a missing pipe line, is expensive business. The new detector has solved this problem by successfully locating pipes laid 40 years ago—pipes buried as much as seven feet below the surface. In one case, pipes were found fully 100 feet from their supposed location, and the detector spotted them within one diameter of the pipe.



NEW LIGHT ON THE MIDDLE AGES

Medieval ecclesiastics would cry "Witchcraft!" could they see the cathedral at Burgos, Spain, tonight. Carefully wrought details of architecture and ornamental carving, never before clearly seen in all their seven hundred years, now stand forth in bold relief. The thirteenth-century Gothic structure glows, for two hours each night, in the light of a battery of modern General Electric floodlights.

Burgos was, for centuries, the capital of Old Castile, the kingdom of that Queen Isabella who offered to pawn her jewels to finance Columbus' momentous voyage to America. Now, after 444 years, American lighting equipment returns to add luster to what was one of the most important of Isabella's possessions.

96-237DH

GENERAL ELECTRIC